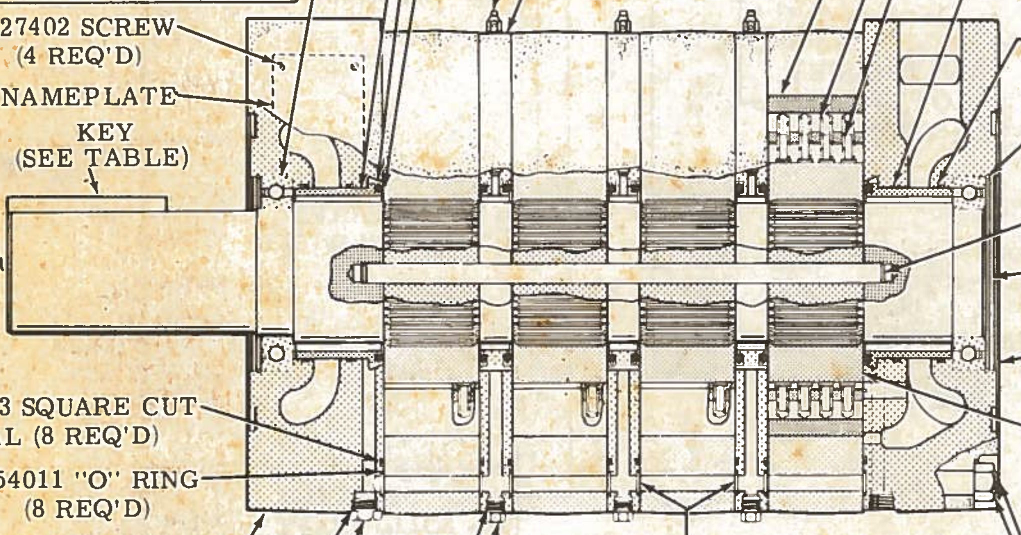
Service Parts Information

VICKERS®
A TRINOVA COMPANY

HIGH TORQUE LOW SPEED VANE MOTORS

MHT-1000-*1-30-S30

MODEL	SHAFT	SNAP RING	KEY	BEARING	PLUG	RING
MHT-1000-R1-30-S30	390616	354386	332265	310539	7074 (1)	343826
MHT-1000-N1-30-S30	———	———	———	———	———	



BEARING (SEE TABLE - 2 REQ'D)
PACK BEARINGS AND SHAFT SPLINE CAVITY WITH FIBROUS TYPE WHEEL BEARING GREASE. INSTALL BEARING WITH SHIELD ON OUTSIDE.

SHAFT (SEE TABLE)
SHAFT MUST HAVE SLIP FIT INTO ROTOR SPLINE WITH MINIMUM BACKLASH. DO NOT FORCE AT ASSEMBLY.

227402 SCREW (4 REQ'D)

NAMEPLATE

KEY (SEE TABLE)

▲281623 SQUARE CUT SEAL (8 REQ'D)

▲154011 "O" RING (8 REQ'D)

630921 BODY (INLET)

▲154130 "O" RING

181792 PLUG

▲154128 "O" RING (3 REQ'D)

181728 PLUG (3 REQ'D)

347255 SLEEVE (2 REQ'D)

418966 RETAINER (8 REQ'D)

▲429293 QUAD SEAL (8 REQ'D)

171255 FITTING (3 REQ'D)

630920 SPACER (3 REQ'D)

SLEEVES MUST BE ASSEMBLED $\frac{0.002}{0.006}$ INCH BELOW INNER SURFACE OF BOTH BODIES TO PREVENT SCORING OF ROTOR.

630922 VANE (72 REQ'D)

309621 SPRING (288 REQ'D)

382716 SPRING GUIDE (288 REQ'D)

○▲271822 BACK-UP RING (4 REQ'D)

▲154108 "O" RING (4 REQ'D)

SNAP RING (2 REQ'D) (SEE TABLE)

422105 PIN (2 REQ'D)

PLUG (SEE TABLE FOR QUANTITIES)

630921 BODY (OUTLET)

630919 ROTOR (4 REQ'D)

223208 NUT (12 REQ'D)
390704 STUD (12 REQ'D)

TORQUE TO 180 ± 5 lb. ft. OILED
ALL 12 STUDS MUST BE INSTALLED SO ENDS ARE BELOW MOUNTING SURFACES.

RING (SEE TABLE - 4 REQ'D)
CAUTION: ASSEMBLE ALL RINGS AND SPACERS WITH CASE DRAIN AS SHOWN. NOT ROTATED 180°.

▲INCLUDED IN SEAL KIT 920017

F3 EQUIVALENT SEAL KIT 920018

WARNING: WEAR SAFETY GLASSES TO PREVENT EYE INJURY.

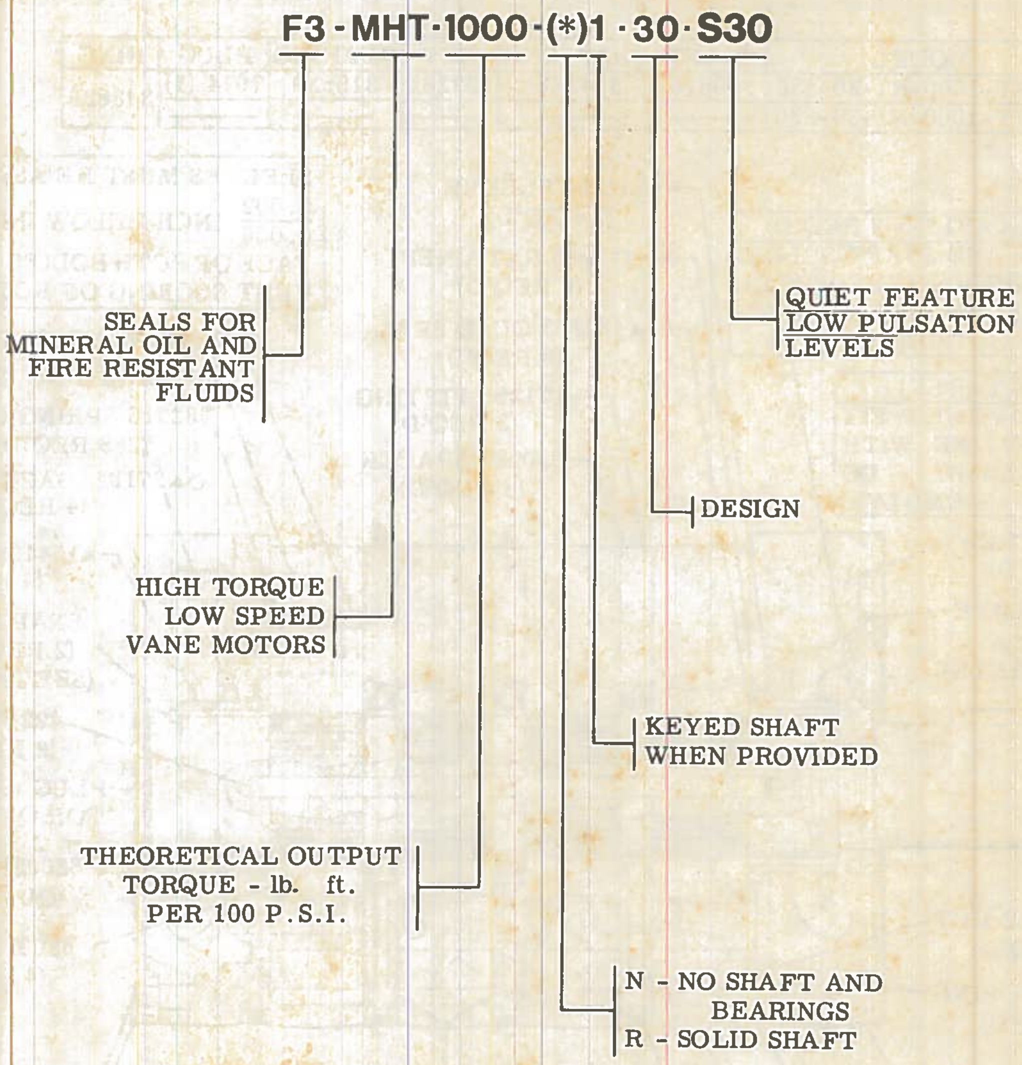
○ INSTALL AS SHOWN TOWARDS OUTER SIDES OF BODIES. PACK WITH GREASE AT ASSEMBLY.

CAUTION: WHEN ASSEMBLING CARTRIDGE, INSERT VANES IN ROTOR SLOTS AT THE MINOR DIAMETER OF CAM RING. ROTATE CARTRIDGE ONE COMPLETE REVOLUTION PRIOR TO ASSEMBLY WITH BODIES. THIS PREVENTS MISALIGNMENT OF SPRINGS AND GUIDES. MAKE SURE THE MARKED ROTOR TOOTH OF EACH CARTRIDGE IS IN LINE BEFORE INSTALLATION OF SHAFT.

Vickers, Incorporated
P.O. Box 302
Troy, Michigan 48007-0302

Released 12-1-85

MODEL CODE BREAKDOWN


F3 - MHT - 1000 - (*)1 - 30 - S30
SEALS FOR MINERAL OIL AND FIRE RESISTANT FLUIDS
HIGH TORQUE LOW SPEED VANE MOTORS
THEORETICAL OUTPUT TORQUE - lb. ft. PER 100 P.S.I.
N - NO SHAFT AND BEARINGS
R - SOLID SHAFT
KEYED SHAFT WHEN PROVIDED
DESIGN
QUIET FEATURE LOW PULSATION LEVELS

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 18/15 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U. S. A.

(30)

Service Parts Information

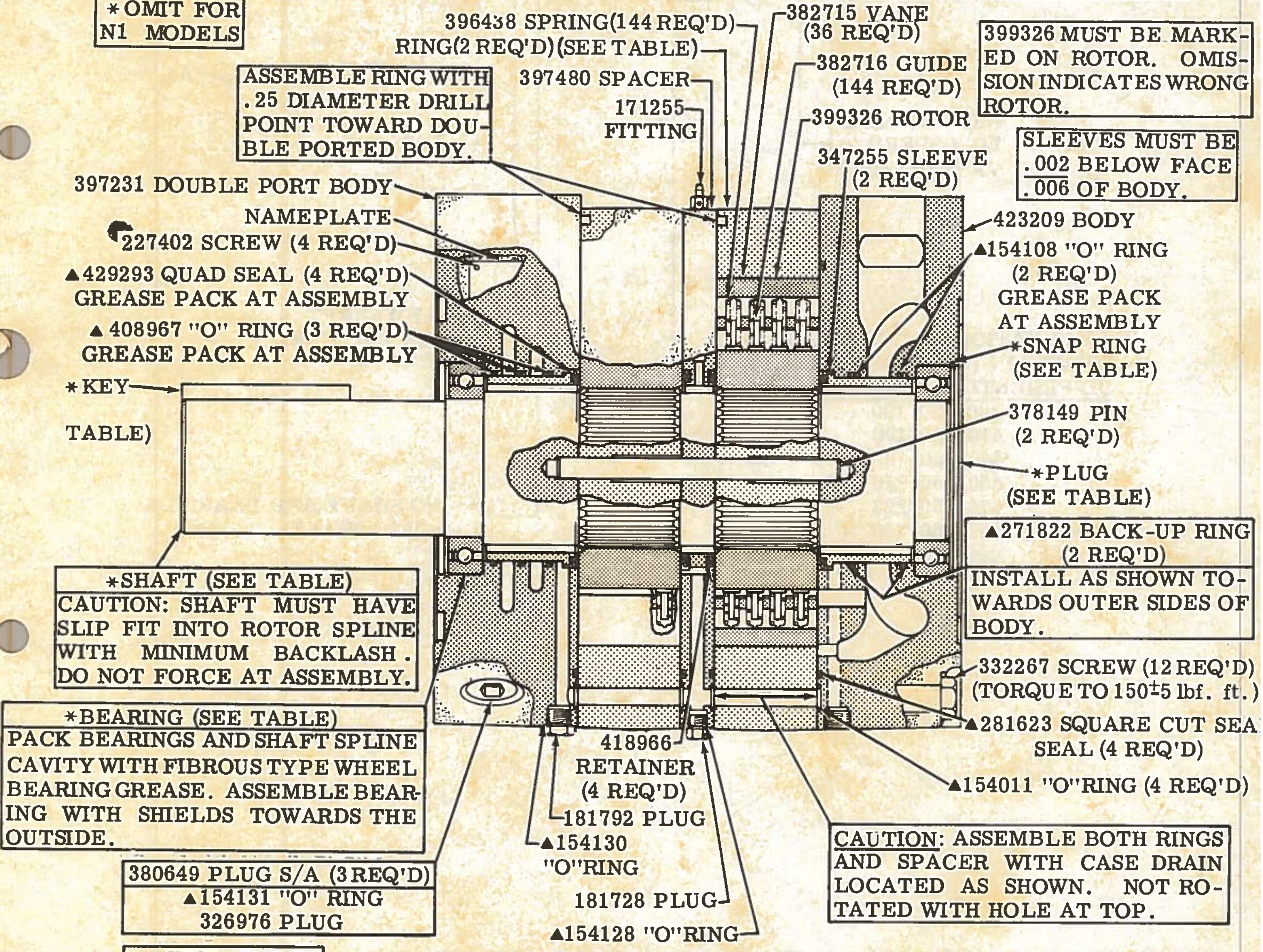
VICKERS
A TRINOVA COMPANY

MULTI-TORQUE VANE MOTORS

MHT SERIES 380 THRU 460

MODEL	SHAFT	SNAP RING (2 REQ'D)	KEY	BEARING (2 REQ'D)	RING "A"	RING "B"	PLUG
MHT-380/190/190-*1-30	377512	354386	332265	310539	364468	364468	7074
MHT-440/250/190-*1-30					375223	375223	
MHT-500/250/250-*1-30					343826	343826	
MHT-410/220/190-N1-30	——	——	——	——	375223	364468	——
MHT-470/250/220-N1-30						343826	
MHT-460/250/210-N1-30-S19					405171	405171	

*OMIT FOR N1 MODELS



ASSEMBLE RING WITH .25 DIAMETER DRILL POINT TOWARD DOUBLE PORTED BODY.

399326 MUST BE MARKED ON ROTOR. OMISSION INDICATES WRONG ROTOR.

SLEEVES MUST BE .002 BELOW FACE .006 OF BODY.

INSTALL AS SHOWN TOWARDS OUTER SIDES OF BODY.

CAUTION: SHAFT MUST HAVE SLIP FIT INTO ROTOR SPLINE WITH MINIMUM BACKLASH. DO NOT FORCE AT ASSEMBLY.

PACK BEARINGS AND SHAFT SPLINE CAVITY WITH FIBROUS TYPE WHEEL BEARING GREASE. ASSEMBLE BEARING WITH SHIELDS TOWARDS THE OUTSIDE.

CAUTION: ASSEMBLE BOTH RINGS AND SPACER WITH CASE DRAIN LOCATED AS SHOWN. NOT ROTATED WITH HOLE AT TOP.

▲INCLUDED IN SEAL KIT 919887

INCLUDED IN F3 SEAL KIT 919888

CAUTION: WHEN ASSEMBLING CARTRIDGE, INSERT VANES IN ROTOR SLOTS AT THE MINOR DIAMETER OF CAM RING. ROTATE CARTRIDGE ONE COMPLETE REVOLUTION PRIOR TO ASSY WITH BODIES. THIS PREVENTS MISALIGNMENT OF SPRINGS AND GUIDES.

Vickers, Incorporated
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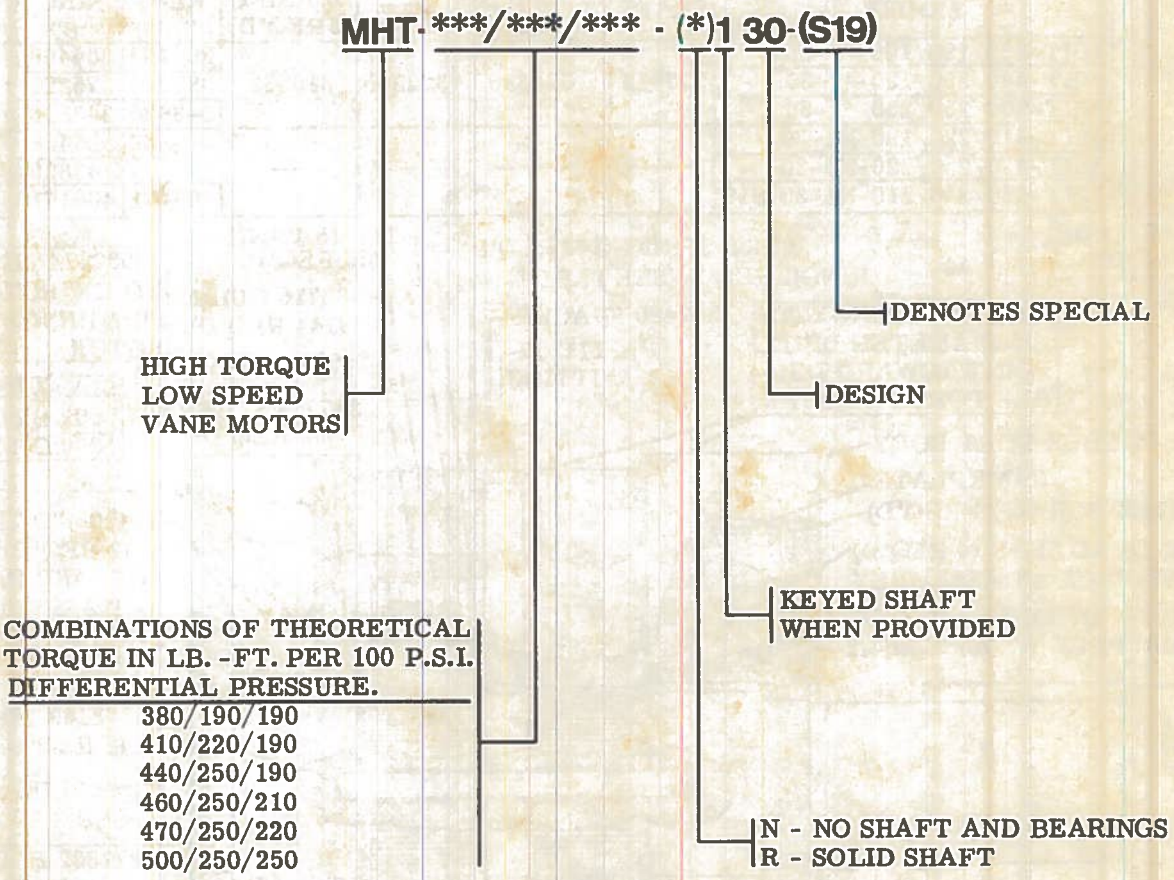
Revised 11-1-85

MODEL CODE BREAKDOWN



MHT-*/***/*** -(*)1 30-(S19)**

DENOTES SPECIAL

DESIGN

HIGH TORQUE
LOW SPEED
VANE MOTORS

KEYED SHAFT
WHEN PROVIDED

COMBINATIONS OF THEORETICAL TORQUE IN LB.-FT. PER 100 P.S.I. DIFFERENTIAL PRESSURE.

380/190/190
410/220/190
440/250/190
460/250/210
470/250/220
500/250/250

N - NO SHAFT AND BEARINGS
R - SOLID SHAFT

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 18/15 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U. S. A.

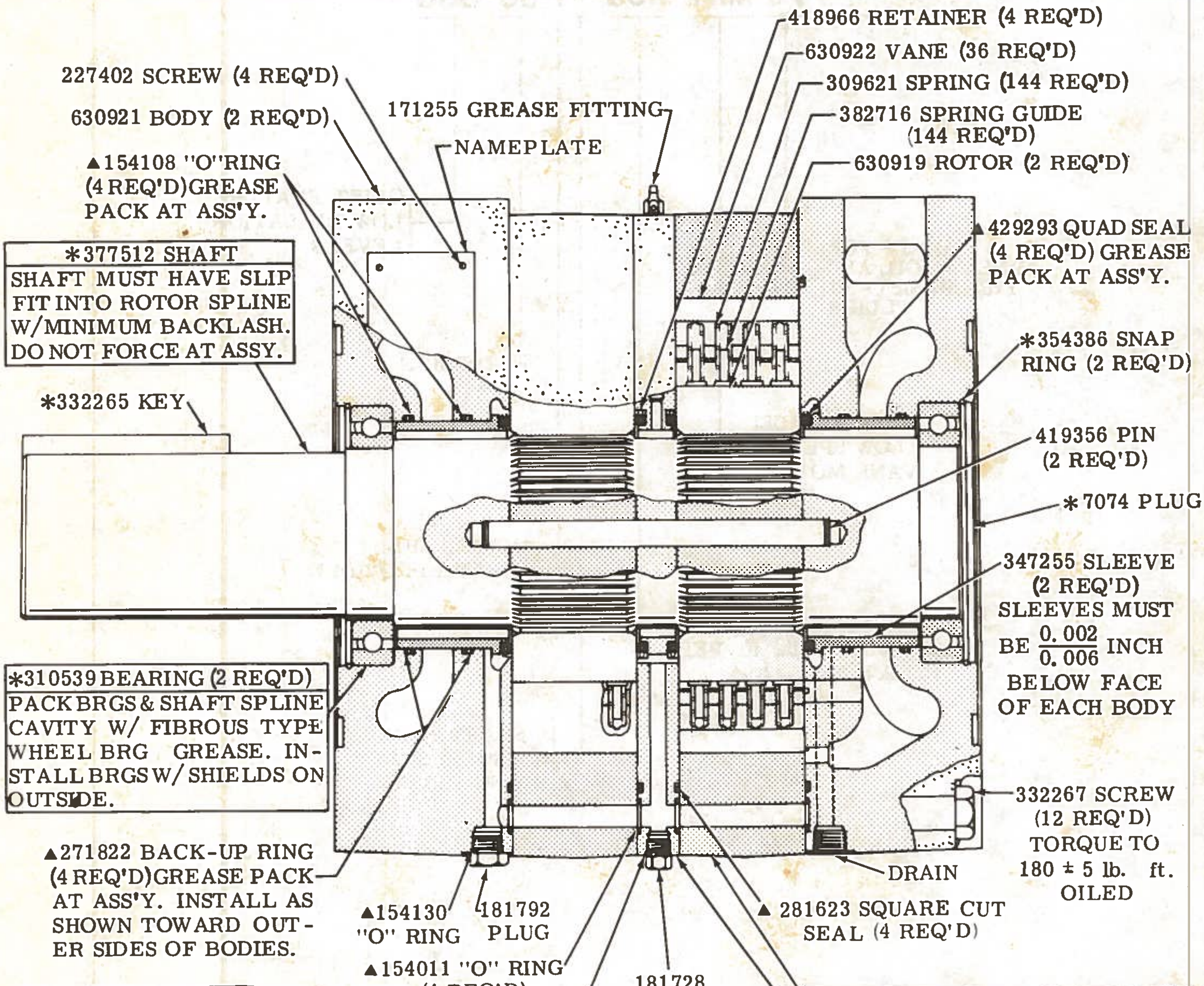
(41)

Service Parts Information

VICKERS
A TRINOVA COMPANY

HIGH TORQUE LOW SPEED VANE MOTORS

MHT-500-*1-30-S30



418966 RETAINER (4 REQ'D)
630922 VANE (36 REQ'D)
309621 SPRING (144 REQ'D)
382716 SPRING GUIDE (144 REQ'D)
630919 ROTOR (2 REQ'D)
227402 SCREW (4 REQ'D)
630921 BODY (2 REQ'D)
171255 GREASE FITTING
NAMEPLATE
▲154108 "O"RING (4 REQ'D)GREASE PACK AT ASS'Y.
*377512 SHAFT
SHAFT MUST HAVE SLIP FIT INTO ROTOR SPLINE W/MINIMUM BACKLASH. DO NOT FORCE AT ASSY.
*332265 KEY
▲429293 QUAD SEAL (4 REQ'D) GREASE PACK AT ASS'Y.
*354386 SNAP RING (2 REQ'D)
419356 PIN (2 REQ'D)
*7074 PLUG
347255 SLEEVE (2 REQ'D) SLEEVES MUST BE 0.002/0.006 INCH BELOW FACE OF EACH BODY
*310539 BEARING (2 REQ'D)
PACK BRGS & SHAFT SPLINE CAVITY W/ FIBROUS TYPE WHEEL BRG GREASE. INSTALL BRGS W/ SHIELDS ON OUTSIDE.
332267 SCREW (12 REQ'D) TORQUE TO 180 ± 5 lb. ft. OILED
▲271822 BACK-UP RING (4 REQ'D)GREASE PACK AT ASS'Y. INSTALL AS SHOWN TOWARD OUTER SIDES OF BODIES.
DRAIN
▲154130 "O" RING
181792 PLUG
▲281623 SQUARE CUT SEAL (4 REQ'D)
▲154011 "O" RING (4 REQ'D)
181728 PLUG
▲154128 "O" RING

STD/F3 SEAL KIT CROSS REFERENCE	
▲STD	F3
919885	919886

343826 RING (2 REQ'D)
630920 SPACER
ASSEMBLE BOTH RINGS & SPACER W/ CASE DRAIN HOLE AS SHOWN. NOT ROTATED W/HOLE AT TOP.

*OMIT FOR N1 MODELS

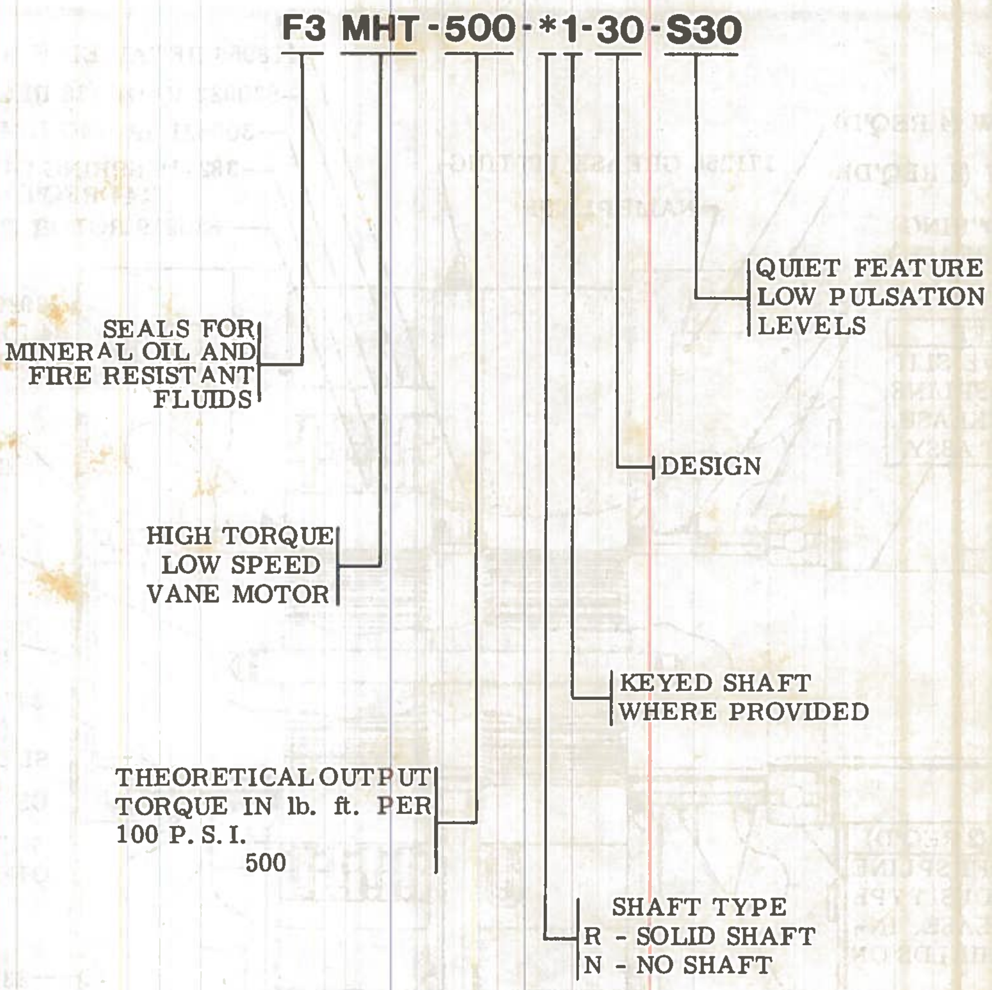
WARNING: WEAR SAFETY GLASSES TO PREVENT EYE INJURY

CAUTION: WHEN ASSEMBLING CARTRIDGE, INSERT VANES IN ROTOR SLOTS AT THE MINOR DIAMETER OF CAM RING. ROTATE CARTRIDGE ONE COMPLETE REVOLUTION PRIOR TO ASSEMBLY WITH BODIES. THIS PREVENTS MISALIGNMENT OF SPRINGS AND GUIDES. MAKE SURE THE MARKED ROTOR TOOTH OF EACH CARTRIDGE IS IN LINE BEFORE INSTALLATION OF SHAFT.

Vickers, Incorporated
P.O. Box 302
Troy, Michigan 48007-0302

Released 12-1-85

MODEL CODE BREAKDOWN


F3 MHT - 500 - *1 - 30 - S30
QUIET FEATURE LOW PULSATION LEVELS
SEALS FOR MINERAL OIL AND FIRE RESISTANT FLUIDS
DESIGN
HIGH TORQUE LOW SPEED VANE MOTOR
KEYED SHAFT WHERE PROVIDED
THEORETICAL OUTPUT TORQUE IN lb. ft. PER 100 P. S. I.
500
SHAFT TYPE
R - SOLID SHAFT
N - NO SHAFT

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 18/15 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U. S. A.

Service Parts Information

VICKERS®
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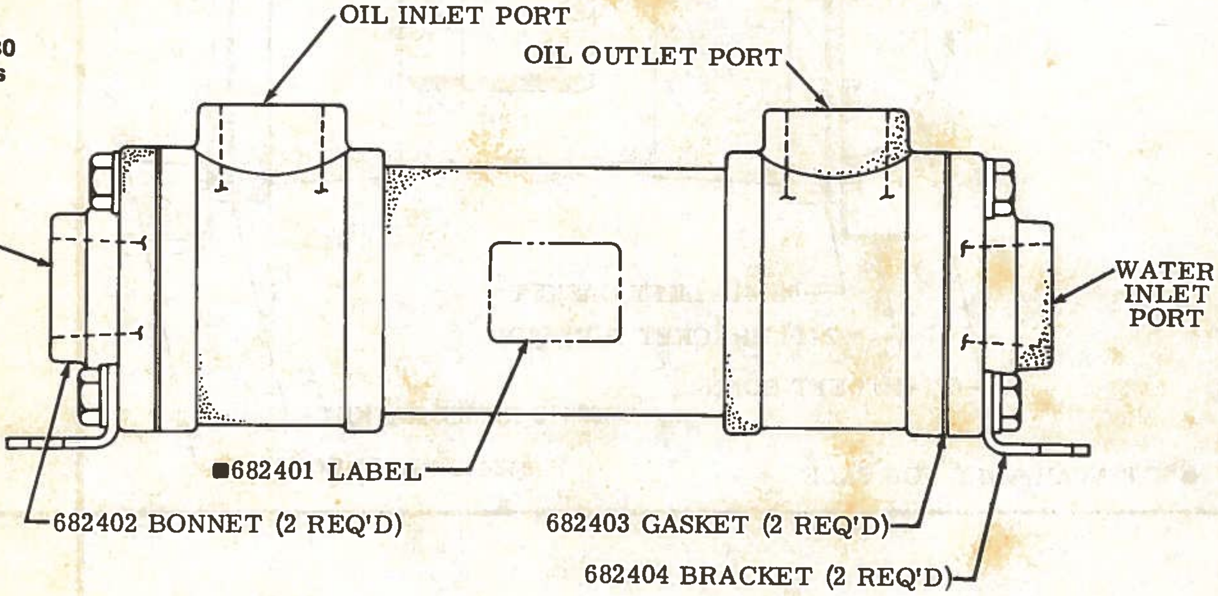
WATER
OIL
COOLERS

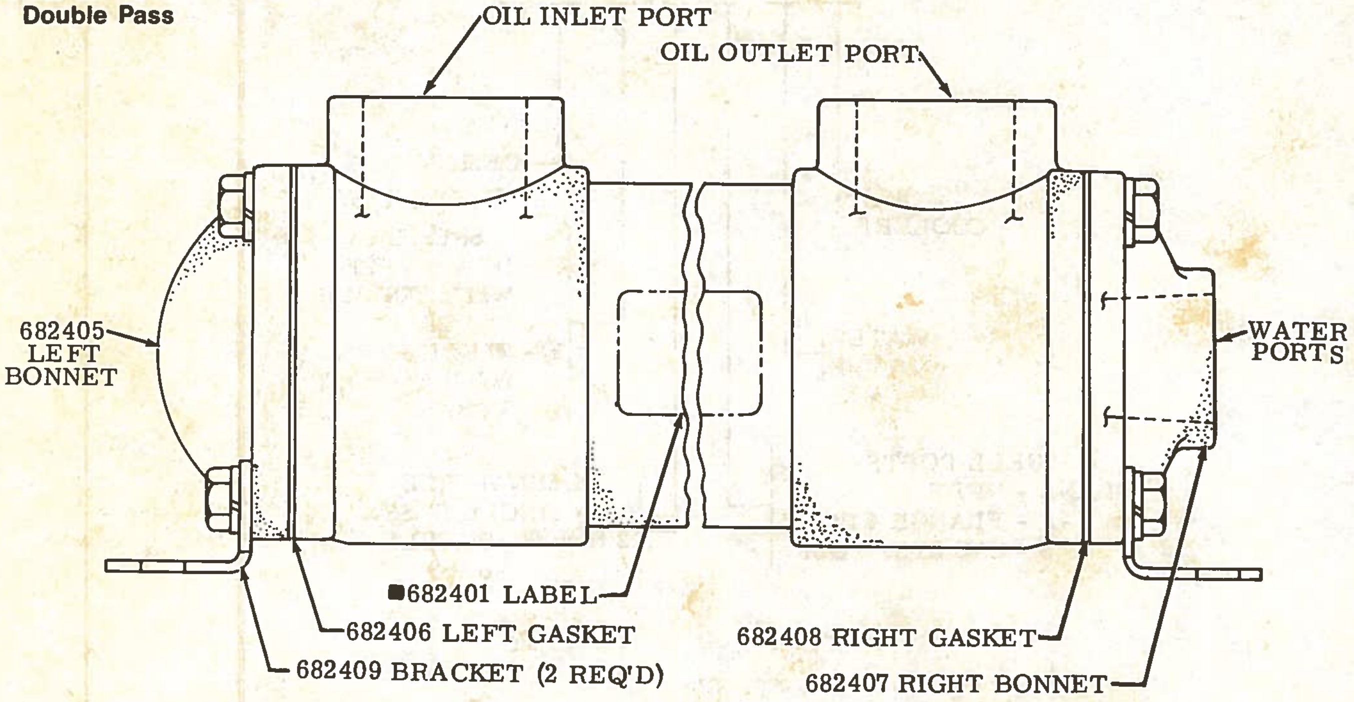
OCW-*-*-*-30

OCW-S-2-F-30
Single Pass



■NOT AVAILABLE FOR SALE

OCW-S-*-F-30
Double Pass

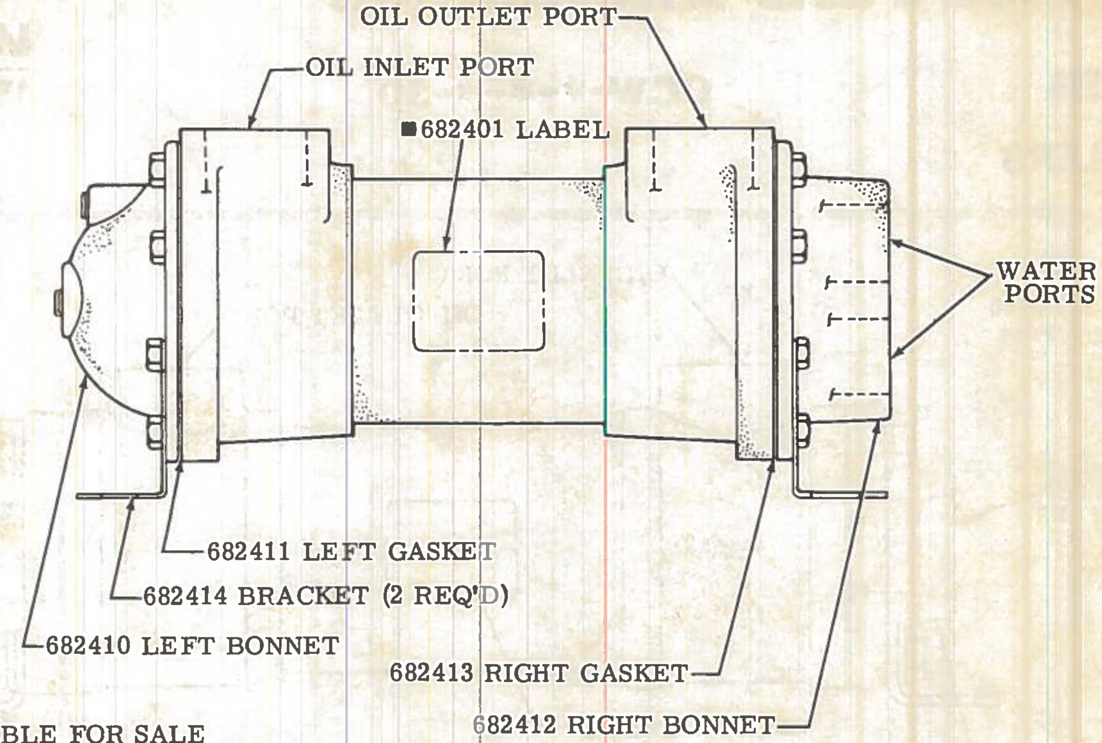


■NOT AVAILABLE FOR SALE

Vickers, Incorporated
1401 Crooks Road
Troy, Michigan 48084

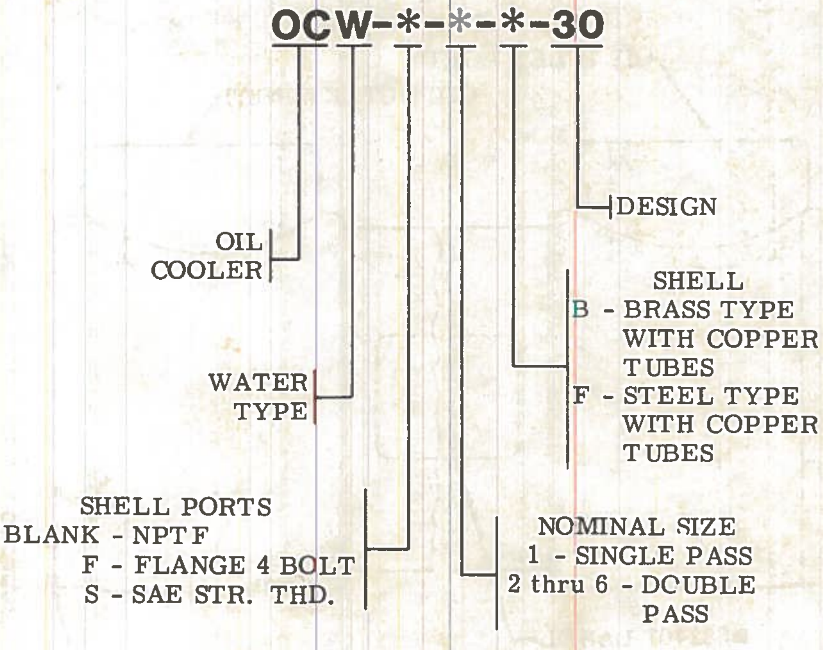
RELEASED 4-1-85

OCW-F-6-F-30
Double Pass



■NOT AVAILABLE FOR SALE

MODEL CODE BREAKDOWN



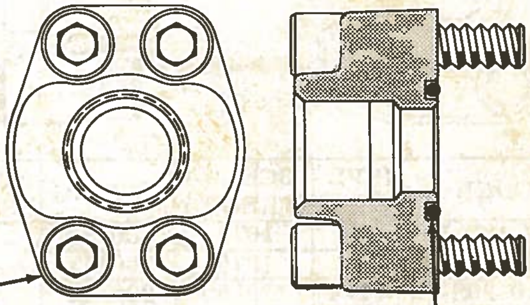
Litho in U. S. A.

Service Parts Information

VICKERS®
A TRINOVA COMPANY

SAE
SOLID 4-BOLT
FLANGES

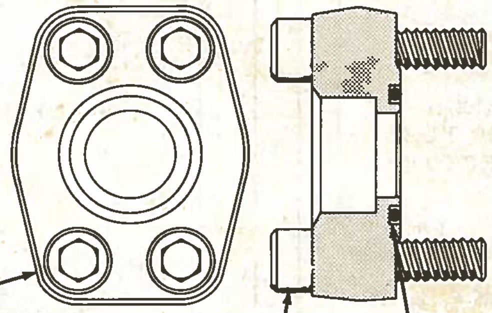
PIPE THREAD



FLANGE (NOT SOLD SEPARATELY)

MODEL NUMBER	PIPE SIZE	SCREW (4 REQ'D)	"O" RING	MAX. PSI PRESSURE
FL1-6-06P-10	3/4	1074	200139	3000
FL1-8-08P-10	1	1075	200143	
FL1-10-10P-10	1-1/4	298150	200145	
FL1-12-12P-10	1-1/2	1116	151296	
FL1-16-16P-10	2		200149	
FL1-20-20P-10	2-1/2	1117	200152	
FL1-24-24P-10	3	298169	200157	
ØFL1-24-24P-LP-10		298168		500

SOCKET WELD



FLANGE (NOT SOLD SEPARATELY)

ORDER THE FLANGES BY COMPLETE MODEL NUMBER. SEALS AND SCREWS ARE INCLUDED.

Ø USED ON 45V SERIES INLET ONLY

MODEL NUMBER	PIPE SIZE	SCREW (4 REQ'D)	"O" RING	MAX. PSI PRESSURE
FL1-8-08W-10	1	1075	200143	3000
FL1-10-10W-10	1-1/4	298151	200145	
FL1-12-12W-10	1-1/2	10955	151296	
FL1-16-16W-10	2	1117	200149	
FL1-20-20W-10	2-1/2	298159	200152	
FL1-24-24W-10	3	298171	200157	
Ø FL1-24-24W-LP-10		298170		500
FL1-28-28W-10	3-1/2	298168	200161	
FL1-32-32W-10	4	298169	200165	

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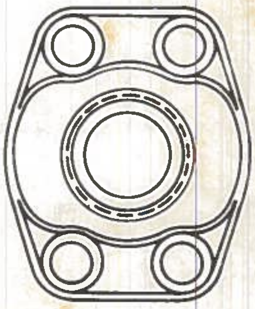
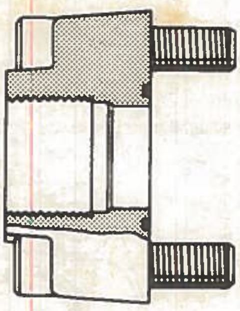
Revised 8-1-86

STRAIGHT THREAD

FLANGE (NOT SOLD SEPARATELY)

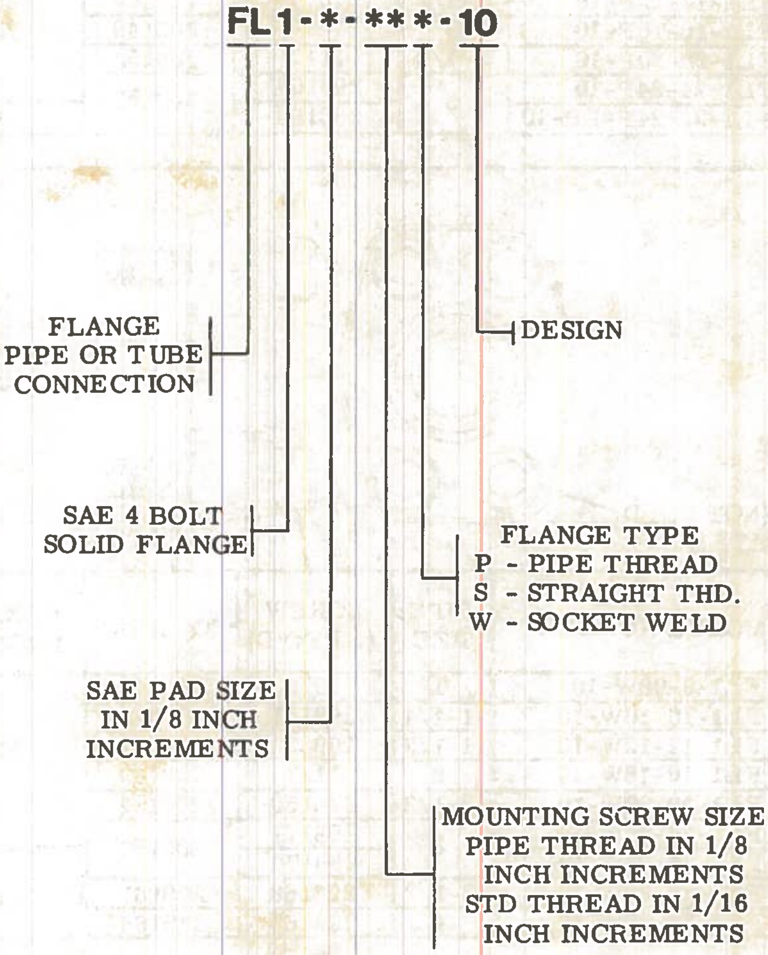




ORDER THE FLANGES BY COMPLETE MODEL NUMBER. SEALS AND SCREWS ARE INCLUDED.

MODEL	PIPE SIZE	SCREW (4 REQ'D)	"O" RING	MAX. PSI PRESSURE
FL1-6-12S-10	3/4	1074	200139	3000
FL1-8-16S-10	1	1075	200143	
FL1-10-20S-10	1-1/4	298150	200145	
FL1-12-24S-10	1-1/2	1116	151296	

MODEL CODE BREAKDOWN



FL1-*-*-10**

FLANGE PIPE OR TUBE CONNECTION

DESIGN

SAE 4 BOLT SOLID FLANGE

FLANGE TYPE
P - PIPE THREAD
S - STRAIGHT THD.
W - SOCKET WELD

SAE PAD SIZE IN 1/8 INCH INCREMENTS

MOUNTING SCREW SIZE PIPE THREAD IN 1/8 INCH INCREMENTS STD THREAD IN 1/16 INCH INCREMENTS

Litho in U. S. A.

Service Parts Information

VICKERS®
A TRINOVA COMPANY

Pressure
Line
Filters

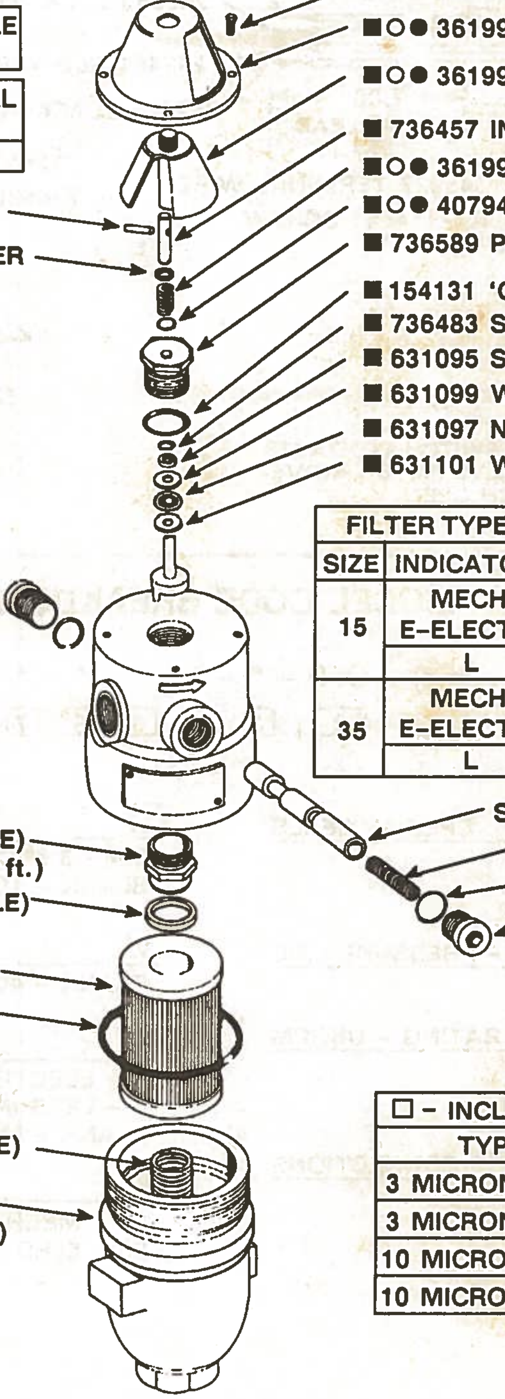
(F3)-OFP-15-*-*-*-*-11/20
(F3)-OFP-35-*-*-*-*-11/20

○ - NOT AVAILABLE FOR SALE AS INDIVIDUAL PARTS

● - INCLUDED IN MECHANICAL INDICATOR KIT 926588

■ - OMIT ON 'L' MODELS

PART NAME	PART NUMBER	
	OFP-15	OFP-35
PLUG	329463	326976
'O' RING	154129	154131
SPRING	736436	736463
SPOOL	736590	736591
BEZEL	736413	736470
SEAL	154018	154022
BOWL 'O' RING	380648	200162
BOWL SPRING	736438	736471
BOWL	736440	736447



FILTER TYPE		○ HEAD TYPE			
SIZE	INDICATOR	B	F	P	S
15	MECH. E-ELECT.	——	——	736418	736419
	L	——	——	736592	736593
35	MECH. E-ELECT.	736469	736466	736467	736468
	L	736603	736600	736601	736602

☐ - INCLUDED IN ELEMENT KIT		
TYPE	OFP-15	OFP-35
3 MICRON (STD)	926410	926414
3 MICRON (F3)	926411	926415
10 MICRON (STD)	926412	926416
10 MICRON (F3)	926413	926417

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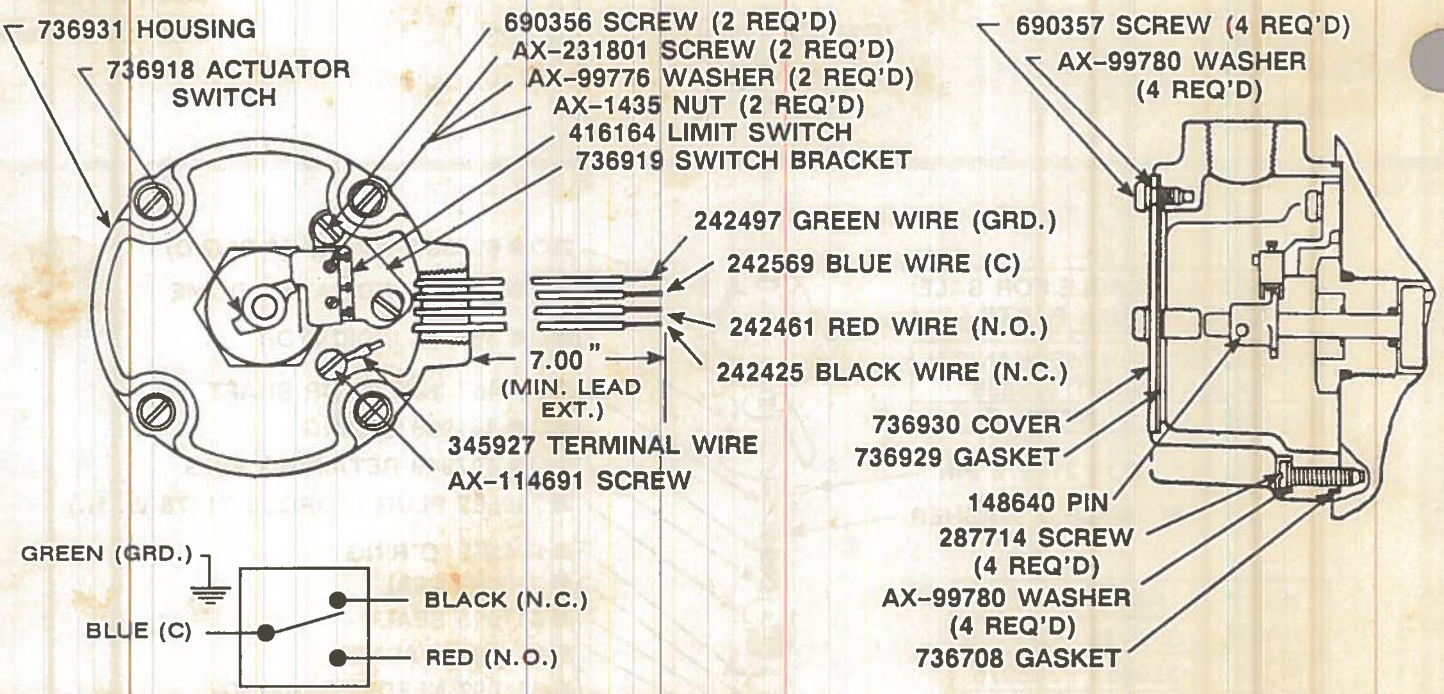
Released 11-1-87

ELECTRICAL INDICATOR PARTS (KIT 926586)



NOTE: ADJUST SWITCH POSITION SO SWITCH CONTACTS MAKE AND BREAK WITH BY-PASS VALVE PISTON MOVEMENT BETWEEN SEATED AND .12 INCH OPEN.

MODEL CODE BREAKDOWN

(F3) – OFP – * – * – * – * – * – *

1 2 3 4 5 6 7 8

1 SPECIAL SEALS

SEALS FOR MINERAL OIL &
FIRE RESISTANT FLUIDS

2 OIL FILTER – PRESSURE LINE

3 FLOW RATING – USGPM

15 – 15 USGPM
35 – 35 USGPM

4 PORT CONNECTIONS

15 SIZE:
- P – 3/4" NPTF THREADS
- S – SAE STRAIGHT THREADS

35 SIZE:
- B – G1 BSPF THREADS
- F – SAE 4 BOLT FLANGE
- P – 1" NPTF THREADS
- S – SAE STRAIGHT THREADS

5 NOMINAL FILTRATION RATING

3M – 3 MICRON
BLANK – 10 MICRON

6 BY-PASS PRESSURE SETTING

BLANK – 40 PSI (STD.)

7 INDICATOR

E – ELECTRICAL
L – LESS INDICATOR
BLANK – MECHANICAL

8 DESIGN

11 – MECHANICAL INDICATOR
20 – ELECTRICAL INDICATOR

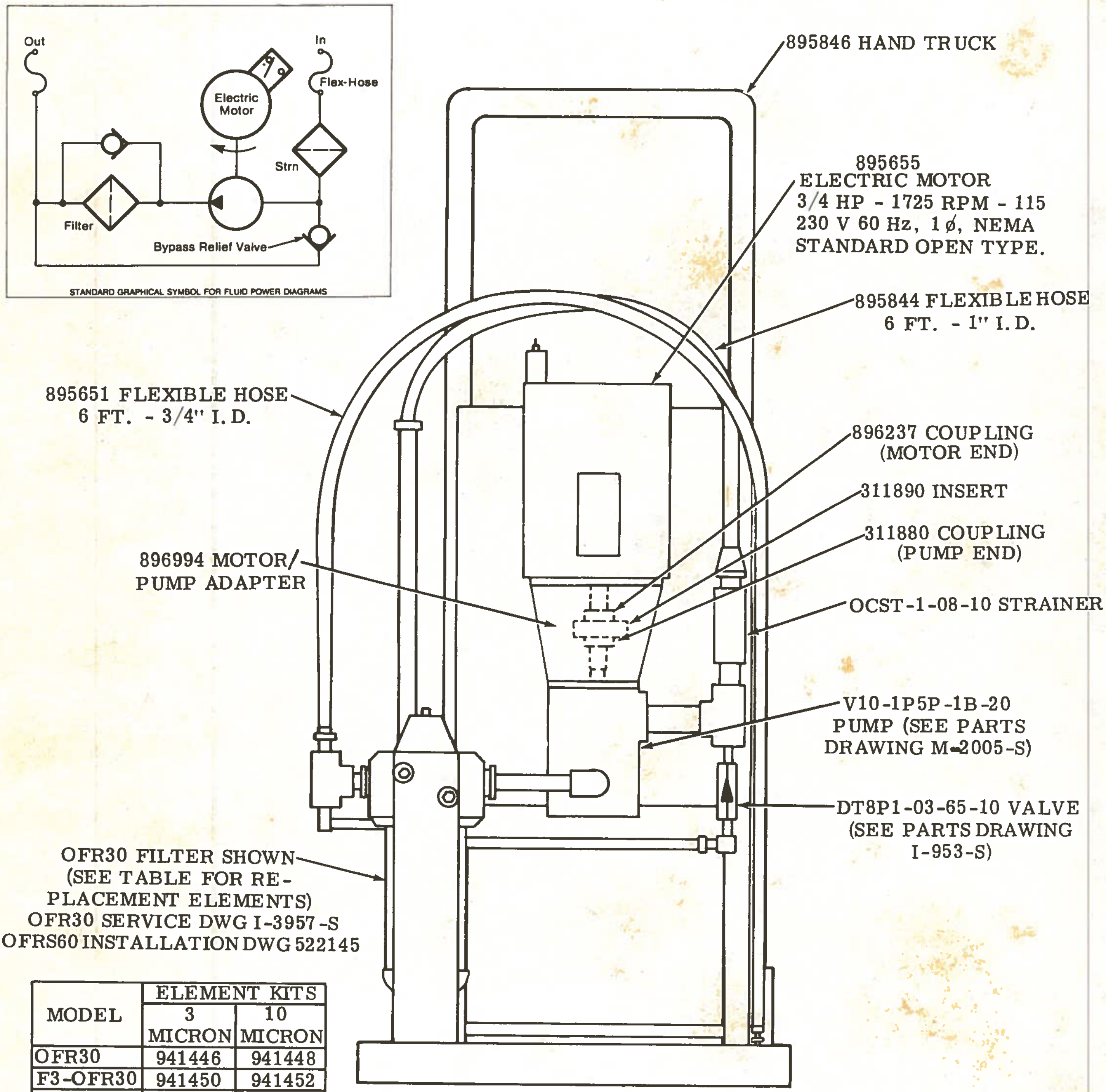
Litho in U.S.A.

Service Parts Information

VICKERS®
A TRINOVA COMPANY

PORTA FILTER & TRANSFER UNIT

(F3)PFTU-OFR30
PFTU-OFRS60



STANDARD GRAPHICAL SYMBOL FOR FLUID POWER DIAGRAMS

MODEL	ELEMENT KITS	
	3 MICRON	10 MICRON
OFR30	941446	941448
F3-OFR30	941450	941452
OFRS60	941190	941107

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Troy, Michigan 48084

REVISED 4-1-86

D. CLEANING

Wash all parts, except bladder (13), sealing ring (9), and o-ring (7) with trichloroethylene or a suitable cold cleansing agent. Wash bladder (13) with methylated spirits or water. Dry off parts for inspection.

E. INSPECTION, REPAIR & PART REPLACEMENT

1. Discard rubber seals and obtain a new anti-extrusion ring kit. Refer to Figure 4 for the kit part number.

2. Visually inspect accumulator bladder (13) for holes, cracks, charring, and distortion. Replace the bladder if any of the preceding conditions are evident. If the bladder seems to be in good contition, perform step 3.

3. Check the bladder for leaks as follows:

a. Screw valve core (3) into bladder.

b. Inflate the bladder with filtered compressed air to 1.4 times its size.

c. Apply a soap solution to the entire bladder surface, including the valve core area. Carefully check the bladder surface and valve core area for leaks. *NO LEAKS ARE ALLOWED.* Replace the bladder if a leak is detected.

4. Inspect oil valve (10) for damaged threads, burrs, and rust spots. Remove minor burrs with an India stone. Check the plunger and spring within the oil valve for proper function. Replace the oil valve if damaged threads, rust spots, or improper plunger/spring action are noted.

5. Inspect both shell (14) openings for burrs. Remove minor burrs with an India stone. Use a flashlight to inspect inside of shell. Check for cracks, scratches, or burrs. If condition of shell is questionable, replace the accumulator.

6. Inspect all other parts for wear and/or damage. Replace any part that looks worn or damaged.

F. ASSEMBLY

Assemble the accumulator in reverse item number sequence as shown in Figure 4. Perform the following steps:

1. Attach the valve core tool to the gas valve portion of bladder (13).

2. Wet inside of shell (14) and outer surface of bladder (13) with clean, system fluid.

3. Fold bladder (13) lengthwise and carefully insert it into oil valve opening of shell. Reach into gas valve opening of shell and grip the valve tool with pliers. Pull on the valve core tool until the gas valve portion of bladder protrudes out of gas valve opening of shell.

4. Insert nameplate (12) over the gas valve and onto shell.

5. Apply a small amount of oil to threads of hex nut (11). Screw hex nut (11) onto gas valve portion of bladder, hand tight. Remove the pull rod.

6. Reach into shell and press on the bladder to remove air from inside of bladder. Thread inner valve guard cap (2) onto gas valve portion of bladder while pressing on bladder. This will prevent the bladder from expanding during installation of anti-extrusion assembly (items 10 thru 5).

7. Dip the shoulder end of oil valve (10) and the sealing ring (9) into clean, system fluid. Hold onto threaded portion of oil valve and position the shoulder end of oil valve into shell opening. Next, fold sealing ring (9) and insert it into shell opening behind the oil valve. Push on the oil valve until the sealing ring fits uniformly around the shoulder end of oil valve.

8. Insert retaining ring (8) into shell opening and onto oil valve (10). Center the retaining ring against the sealing ring. Pull the oil valve outwards through the shell opening.

9. Remove inner valve guard cap (2). Install valve core (3) into gas valve portion of bladder with the valve core tool.

10. Fill bladder (13) with compressed air while centering the oil valve and retaining ring at opposite end of accumulator shell.

11. Wrap masking tape around threaded portion of oil valve (10).

12. Install washer (7), o-ring (6), and back-up ring (5) onto oil valve. Push the o-ring and back-up ring uniformly into shell with a blunt screwdriver. Remove the masking tape and apply a small amount of oil to the oil valve threads.

13. Screw slotted nut (4) onto oil valve (10). Tighten the nut securely with a spanner wrench. (Note: Make sure the oil valve does not turn while tightening the slotted nut. Secure the oil valve with a vise or large wrench.)

14. Apply a small amount of oil to pipe (bleeder) plug (4) threads. Screw the plug into oil valve (10).

15. Push on valve core (3) to release air from bladder (13). Remove the valve core to insure all the air is released from bladder. Reinstall the valve core.

16. Install inner valve guard cap (2) over the valve core.

17. Pour a liberal amount of system fluid (approximately 1/10th accumulator content) into oil valve port. Use a funnel for this operation. This step insures the proper lubrication of the bladder and inner shell surface. Roll the accumulator back and forth two or three times. Drain off the fluid. Remove inner valve guard cap (2).

18. Pre-charge the accumulator with nitrogen to approximately 10 PSI. Follow accumulator pre-charge instruction in Section IV. Tighten hex nut (11). Continue to pre-charge the accumulator until the correct pressure for your application is obtained.

19. Apply a soap solution to the valve core area of the accumulator. Check for leaks. *NO LEAKS ARE ALLOWED.* If the accumulator does not accept a pre-charge, refer to the troubleshooting chart (Table 4) for possible repair solutions.

20. Install inner valve guard cap (2) and outer valve guard cap (1).

21. When the accumulator is placed into service, refer to Section III–Installation & Maintenance and the installation drawing for proper instructions.

22. Check the pre-charge pressure within a week of initial pre-charge. The pressure should be checked with zero hydraulic pressure on the circuit. Disconnect the accumulator from the circuit by turning off the line valve and opening the valve to the reservoir.

Item No.	Part Name	Part Numbers				
		Model A1-75-30 (1 Quart)	Model A1-200-30 (1 Gallon)	Model A1-550-30 (2.5 Gallon)	Model A1-1050-30 (5 Gallon)	Model A1-2050-30 (10 Gallon)
1	Outer Valve Guard Cap ⊖ ●	682428	682428	682428	682428	682428
2	Inner Valve Guard Cap ⊖ ●	682427	682427	682427	682427	682427
3	Valve Core ●	682450	682450	682450	682450	682450
11	Hex Nut ●	682426	682426	682426	682426	682426
12	Nameplate	682415	633106	633107	633107	633107
13	Bladder Assembly STD. ● F3	926380 926573	926381 926574	926382 926575	926383 926576	926384 926577
14	Shell (Not for sale)	—	—	—	—	—
4	Slotted Nut ○	○(STD.) 926385 (F3) 926578	○(STD.) 926386 (F3) 926579	○(STD.) 926387 (F3) 926580	○(STD.) 926387 (F3) 926580	○(STD.) 926387 (F3) 926580
5	Backup Ring ○					
6	"O" Ring ■ ○					
7	Washer ○					
8	Retaining Ring ○					
9	Sealing Ring ○					
10	Oil Valve Kit STD. ■ F3	926496 926581	926497 926582	926498 926583	926498 926583	926498 926583

● Included in STD. bladder assembly.
F3 equivalent bladder assembly.
⊖ Included in valve guard cap kit 926532
○ Included in STD. anti-extrusion ring kit.
F3 equivalent anti-extrusion ring kit.
■ Included in STD. oil valve kit.
F3 equivalent oil valve kit.

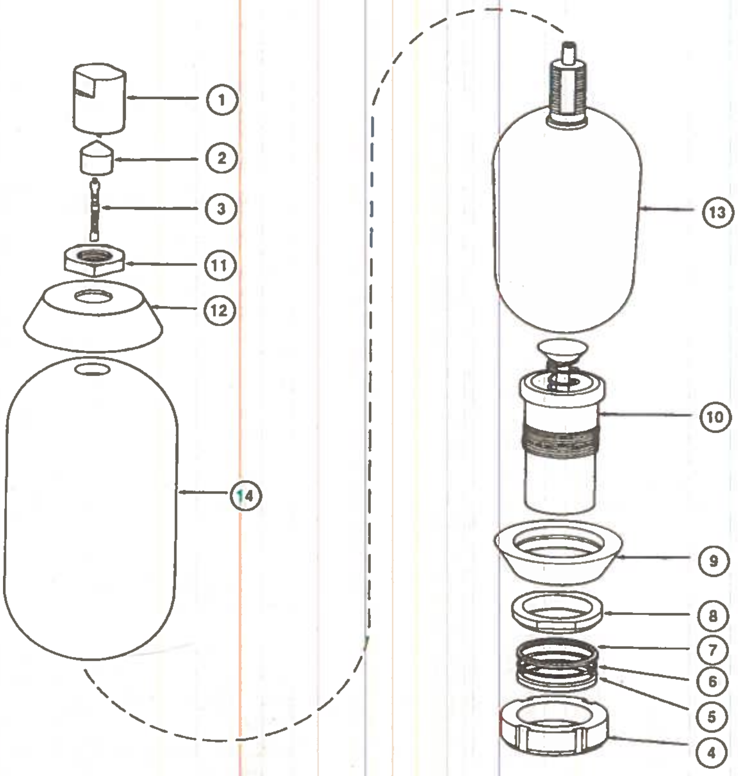


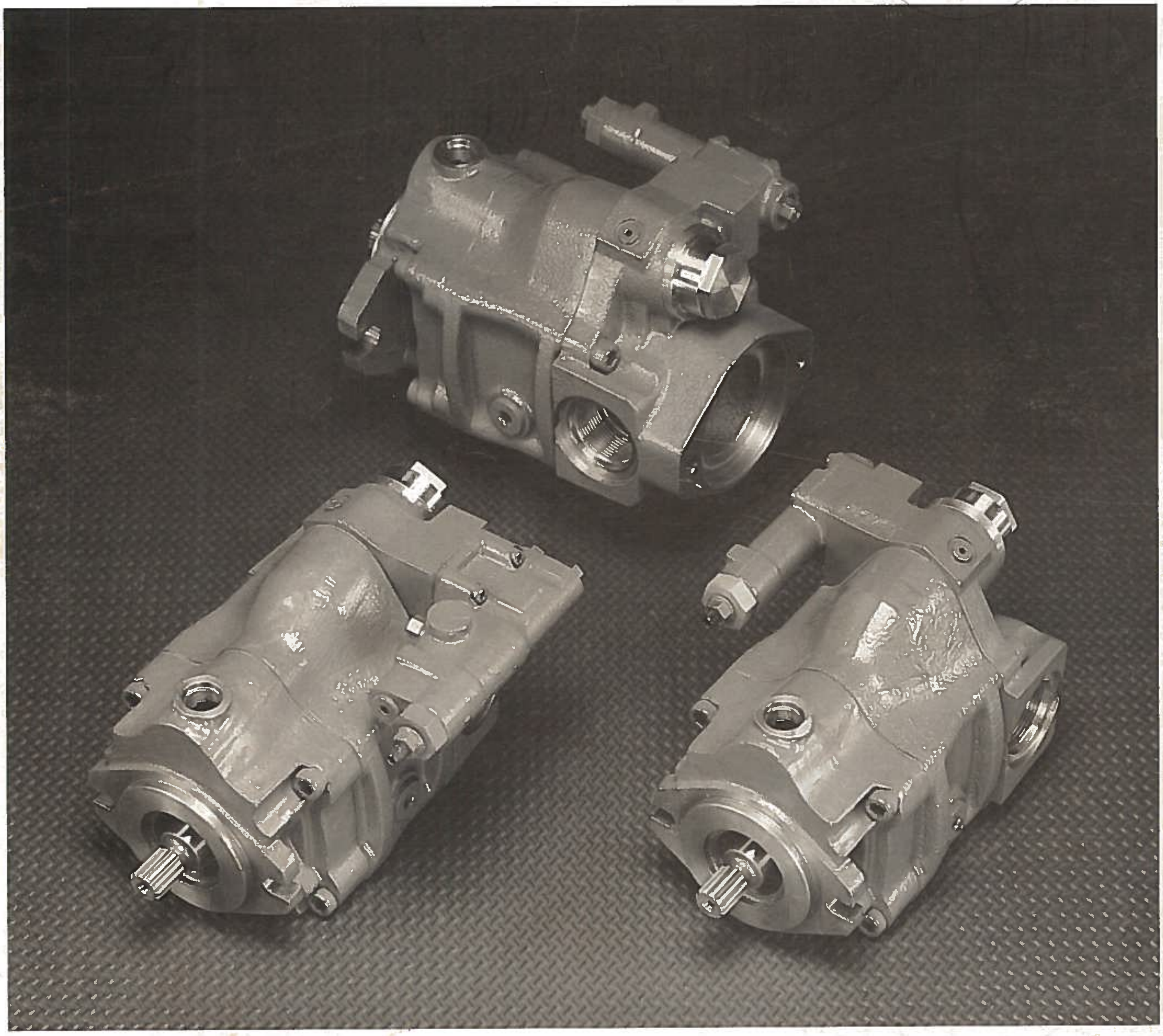
Figure 4. Exploded View

VICKERS

Variable Displacement Piston Pumps for Mobile Applications

PVQ700 Family
21,1 to 141 cm^3/r (1.29 to 8.64 in^3/r) Displacements
230 bar (3300 psi) Max. Pressure

7



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PVQ700 mobile pumps are open circuit, axial piston designs. A variety of controls provides the ability to match the pumps to each application.

A strong, proven rotating group allows the pumps to handle pressures to 230 bar (3300 psi) continuous and 250 bar (3600 psi) intermittent – with less maintenance cost. High-load bearings and a stiff drive shaft help provide a pump life of 5000 hours at rated mobile conditions, reducing operating costs and extending operating life.

PVQ700 pumps feature a saddle-type yoke with steel-backed polymer bearings. The stiff yoke reduces deflection and allows even loading of bearings, improving life. A single control piston reduces loading on the yoke, resulting in reduced pump size which allows installation in tighter locations.

PVQ700 pumps operate at a level of quietness that exceeds the requirements of today's demanding work conditions. The pumps feature a unique three-piece envelope (flange, housing and valve block) specifically created for low fluid-borne and structure-borne noise levels. Another pump feature – a bimetal timing plate – improves pump filling characteristics which, in turn, reduce fluid-borne noise and extend pump life.

An adjustable maximum stop provides a means of tuning flow to your system, while gauge ports allow monitoring of inlet and outlet conditions. These standard features reduce system complexity and cost.

Mounting flanges are offered in SAE and ISO configurations, and ports are offered in SAE, ISO, and BSPP in both tube and flange versions. This provides a wide variety of installation opportunities for global machine design.

Side- or end-ported models are available to facilitate plumbing and help fit the pump to your machine space needs. Multiple drain ports allow many mounting orientations, reducing installed costs.

PVQ700 pumps are capable of operating with many types of hydraulic fluids used in industrial and mobile systems. High-water-content and phosphate ester fluids can be accommodated, in addition to the typical petroleum based and synthetic fluids.

With a PVQ pump you can have smaller and quieter power units at higher pressures. Your systems will have lower vibration levels on the system piping, helping to ensure a leak-free system.

Typical Applications

Mobile

- Loader backhoes
- Container handling cranes
- Vibratory cable plows
- Mining machinery
- Utility boom trucks
- Dump truck lifts
- Agriculture tractors
- Chemical applicator trucks
- Railroad equipment

Features & Benefits

- Long pump life
- Quiet pump operation
- Inlet and outlet gauge ports and adjustable maximum displacement stop – standard
- Astonishingly low 4% pressure ripple
- Low installed and operating costs
- Reduced maintenance
- Design flexibility
- Compact size saves space
- Design promotes leak-free system

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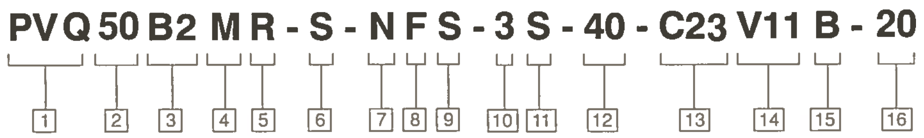
Model Code



1 Pump series (pressure rating)

PVQ – 230 bar (3300 psi) continuous
250 bar (3600 psi) intermittent

2 Maximum geometric displacement cm^3/r (in^3/r)

See following page.

3 Mounting flange

See following page.

4 PVQ700 family speed rating

M – Mobile equipment speeds at zero inlet.

5 Rotation viewed from shaft end

R – Right hand (clockwise)
L – Left hand (counterclockwise)

6 Adjustable maximum displacement stop

S – With stop
F – Without stop

7 Thru-drive options

See following page for thru-drive coupling combinations.

8 Main port options

See page 7.

9 Main port locations

E – End
S – Sides

10 Shaft end type

See Page 7.

11 Shaft seal at prime mover end

S – Single shaft seal, one way
D – Double shaft seal, two way
N – No shaft seal

12 Pump design number

40 – For PVQ20, PVQ50, PVQ63 and PVQ141
50 – For PVQ81 and PVQ106

Subject to change. Installation dimensions remain unaltered for designs 40–49 and 50–59.

13 Pump control options

C** – Pressure compensator; 100–210 bar (1500–4000 psi). Asterisks denote maximum pressure setting in tens of bar. "C23" – 230 bar (3300 psi) – is standard.

CM** – Pressure compensator; 20–100 bar (300–1500 psi). Asterisks denote maximum pressure setting in tens of bar. "CM7" – 70 bar (1000 psi) – is standard.

14 Additional control functions

Blank – No additional control functions.

V** – Load sensing control. 6–14 bar (90–200 psi). Asterisks denote differential setting in bar. "V11" is standard 11 bar (160 psi) factory setting.

VC** – High differential spring. 15–25 bar (218–363 psi). For PVQ20 & PVQ50, "VC24" is standard 24 bar (350 psi) factory setting. For PVQ63, 81, 106 & 141, "VC20" is standard 20 bar (300 psi) factory setting.

VX** – For PVQ81 and PVQ106 only. Extra high differential spring. 26-40 bar (377–580 psi). "VX35" is standard 35 bar (508 psi) factory setting.

15 Bleed down orifice option for load sense control

B – Bleed-down orifice installed in control.
P – Orifice plugged. No bleed-down in control.

16 Control design number

20 – For all PVQ20 & PVQ50 controls
31 – For all PVQ63 and PVQ141 controls
40 – For all PVQ81 and PVQ106 controls

Model Code

2 Maximum geometric displacement

	Code					
Displacement	**20**	**50**	**63**	**81**	**106**	**141**
cm^3/r	21,1	50,0	63,1	81,0	106,5	141,0
in^3/r	1.29	3.05	3.85	4.94	6.50	8.60

3 Mounting flange specifications

Code	Description	PVQ20	PVQ50	PVQ63	PVQ81	PVQ106	PVQ141
A2	SAE J744-82-2 (A, 2-bolt)	●	○	○	○	○	○
MA2	ISO 3019/2-80A2HW	●	○	○	○	○	○
B2	SAE J744-101-2 (B, 2-bolt)	●	●	●	○	○	○
MB2	ISO 3019/2-100A2HW	●	●	●	○	○	○
C2	SAE J744-127-2 (C, 2-bolt)	○	○	●	●	●	●
MC2	ISO 3019/2-125A2HW	○	○	●	●	●	●
C4	SAE J744-127-4 (C, 4-bolt)	○	○	●	●	●	●
MC4	ISO 3019/2-125B4HW	○	○	●	●	●	●
D4	SAE J744-152-4 (D, 4-bolt)	○	○	○	○	○	●
MD4	ISO 3019/2-160B4HW	○	○	○	○	○	●

●=Available
○=Not available

7 Thru-drive options

Code	Description	PVQ20	PVQ50	PVQ63	PVQ81	PVQ106	PVQ141
N	Single pump, non-thru-drive	●	●	●	●	●	●
A9	SAE A, 2-bolt, 9T spline	●	●	●	●	●	●
A11	SAE A, 2-bolt, 11T spline	●	●	○	●	●	●
B13	SAE B, 2-/4-bolt, 13T spline	○	●	●	●	●	●
B15	SAE B-B, 2-/4-bolt, 15T spline	○	●	●	●	●	●
C14	SAE C, 2-/4-bolt, 14T spline	○	○	●	●	●	●
C17	SAE C-C, 2-/4-bolt, 17T spline	○	○	○	●	●	●
MA9	ISO 80-A2HW, 9T SAE spline	●	●	●	●	●	●
MA11	ISO 80-A2HW, 11T SAE spline	●	●	○	●	●	●
MB13	ISO 100-A2/B4HW, 13T SAE spline	○	●	●	●	●	●
MB15	ISO 100-A2/B4HW, 15T SAE spline	○	○	●	●	●	●
MC14	ISO 125-A2/B4HW, 14T SAE spline	○	○	●	●	●	●
MC17	ISO 125-A2/B4HW, 17T SAE spline	○	○	○	●	●	●

●=Available
○=Not available

8 Main port options

Code	Description	Inlet/Outlet	PVQ20	PVQ50	PVQ63	PVQ81	PVQ106	PVQ141
S	SAE J514 Tube Ports	Inlet	–20	–24	–24 (End ports only)	–	–	–
		Outlet	–12	–16	–16 (End ports only)	–	–	–
F	SAE J518 Flange Ports	Inlet	1.25 inch	2.0 inch	2.0 inch	2.0 inch	2.5 inch	2.5 inch
		Outlet	0.75 inch	1.0 inch	1.0 inch	1.0 inch	1.0 inch	1.25 inch*
D	ISO 6149-1 Tube Ports	Inlet	M42	M48	M48 (End ports only)	–	–	–
		Outlet	M27	M33	M33 (End ports only)	–	–	–
M	ISO 6162 Flange Ports	Inlet	32mm	51mm	51mm	51mm	64mm	64mm
		Outlet	19mm	25mm	25mm	25mm	25mm	32mm*
B	British Standard Parallel Pipe – Tube Ports	Inlet	G 1-1/4	G 1-1/2	–	–	–	–
		Outlet	G 3/4	G 1	–	–	–	–

* SAE Code 62, high pressure series, or ISO 400 bar. Other flange ports are SAE Code 61, standard pressure series, or ISO 25–350 bar.

10 Shaft-end type at prime mover end

	Shaft Code					
Description	PVQ20	PVQ50	PVQ63	PVQ81	PVQ106	PVQ141
SAE J744-16-1, SAE A, Straight keyed	1	–	–	–	–	–
SAE J744-19-1, SAE 19-1, Straight keyed	2	–	–	–	–	–
SAE J744-16-4, SAE A, 9T Spline	3	–	–	–	–	–
SAE J744-16-4, SAE A, 11T Spline	4	–	–	–	–	–
SAE J744-22-1, SAE B, Straight Keyed	5	1	–	–	–	–
SAE J744-25-1, SAE B-B, Straight Keyed	6	2	6	–	–	–
SAE J744-22-4, SAE B, 13T Spline	7	3	7	–	–	–
SAE J744-25-4, SAE B-B, 15T Spline	8	4	8	–	–	–
SAE J744-32-1, SAE C, Straight Keyed	–	–	1	1	1	1
SAE J744-38-1, SAE C-C, Straight Keyed	–	–	–	2	2	2
SAE J744-32-4, SAE C, 14T Spline	–	–	3	3	3	3
SAE J744-38-4, SAE C-C, 17T Spline	–	–	–	4	4	4
SAE J744-44-1, SAE D, Straight Keyed	–	–	–	–	–	5
SAE J744-44-4, SAE D, 13T Spline	–	–	–	–	–	6
ISO 3019/2 E20N, Straight Keyed, Short Spigot	N1(1)	–	–	–	–	–
ISO 3019/2 E25N, Straight Keyed, Short Spigot	N2(2)	–	–	–	–	–
ISO 3019/2 E25N, Straight Keyed, Short Spigot	N3(3)	N1	N3	–	–	–
ISO 3019/2 E32N, Straight Keyed, Short Spigot	–	–	N1	N1	N1	N1
ISO 3019/2 E40N, Straight Keyed, Short Spigot	–	–	–	N2	N2	N2

(1) ISO 80mm Pilot only - MA2
(2) ISO 80mm Pilot only - MA2
(3) ISO 100mm Pilkot only - MB2

Specifications & Performance

Displacement, Pressure and Flow Ratings At 93°C (200°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Model Series	Maximum Geometric Displacement cm^3/r (in^3/r)	Maximum Pressure bar (psi)			Maximum Flow at 210 bar (3000 psi)	
		Continuous	Intermittent †	Peak ‡	Flange Ports l/min (USgpm) @1 bar inlet	Tube Ports l/min (USgpm) @1 bar inlet
PVQ20	20,1 (1.22)	230 (3300)	250 (3600)	280 (4000)	53 (14) @2800 r/min	53 (14) @2800 r/min
PVQ50	50,0 (3.05)				125 (33) @2600 r/min	116 (31) @2400 r/min
PVQ63	63,1 (3.85)				150 (40) @2500 r/min	140 (37) @2400 r/min
PVQ81	81,0 (4.94)				181 (48) @2400 r/min	–
PVQ106	106,5 (6.50)				222 (59) @2200 r/min	–
PVQ141	141,0 (8.60)				258 (68) @2000 r/min	–

† Less than 10% of duty cycle.

‡ Momentary system pressure spikes only.

Speed, Input Power and Torque Ratings At 93°C (200°F), SAE 10W oil, 1 bar absolute (0 psig) inlet

Model Series	Maximum Operating Speed r/min			Max. Input Power at Max. Speed at 210 bar (3000 psi) kW (hp)	Max. Torque at 210 bar (3000 psi) Nm (lb-ft)	Approximate Weight (dry) kg (lbs)
	1 bar Inlet		.85 bar Inlet			
	Flange Ports	Tube Ports	Flange Ports			
PVQ20	2800 r/min			21 (28)	72 (53)	15 (33)
		2800 r/min		21 (28)		
			2600 r/min	20 (27)		
PVQ50	2600 r/min			51 (68)	204 (150)	24 (52)
		2400 r/min		48 (64)		
			2200 r/min	44 (59)		
PVQ63	2500 r/min			59 (79)	225 (166)	36 (79)
		2400 r/min		57 (76)		
			2200 r/min	52 (69)		
PVQ81	2400 r/min			69 (93)	276 (204)	45 (99)
			1900 r/min	55 (74)		
PVQ106	2200 r/min			87 (117)	377 (278)	55 (121)
			1800 r/min	70 (94)		
PVQ141	2000 r/min			102 (137)	483 (356)	66 (145)
			1600 r/min	81 (109)		

Standard Response Times†

Model Series	On Stroke msec	Off Stroke msec
PVQ20	57	22
PVQ50	140	23
PVQ63	94	20
PVQ81	135	30
PVQ106	90	25
PVQ141	128	28

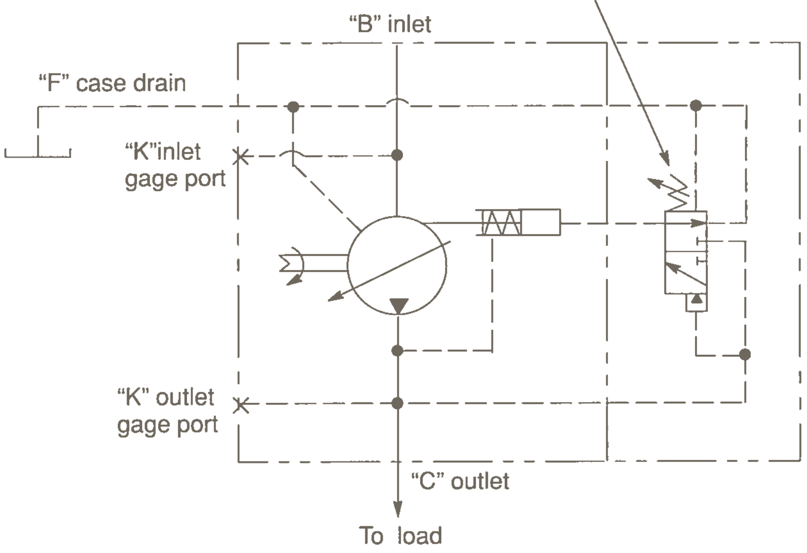
† Values with pressure compensator control.

C**, CM** Pressure Compensator Control

The pump will provide a continuously modulated flow to meet changing load demands at a pre-adjusted compensator pressure. At pressures below the compensator setting, the pump will operate at maximum displacement. See model code on page 5 for compensator pressure ranges.

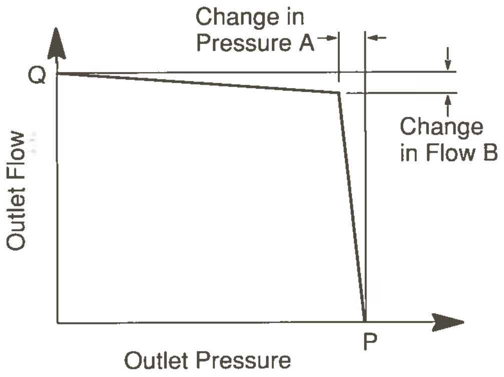
WARNING: The pressure compensator may be adjusted beyond the rated pressure of the pump. When adjusting the pressure limiter, install a 0–350 bar (0–5000 psi) gage in the outlet gage port and limit the pressure setting to 230 bar (3300 psi).

See model code on page 5 for spring (pressure) adjustment ranges.



Pressure Cut-off Characteristics of "C21" Pressure Compensator Control

@ 93°C (200°F), static conditions



Model Series	Rated Speed r/min	"Q" Outlet Flow l/min (USgpm)	"P" Outlet Pressure bar (psi)	A bar (psi)	B L/min (USgpm)
PVQ20	2800	52 (14)	230 (3300)	2,8 (41)	4,5 (1.2)
PVQ50	2600	125 (33)		10 (150)	4,5 (1.2)
PVQ63	2500	159 (42)		7,4 (107)	11,4 (3.00)
PVQ81	2400	185 (49)		1,5 (22)	37 (9.78)
PVQ106	2200	234 (62)		1,5 (22)	24 (6.33)
PVQ141	2000	258 (68)		7,0 (100)	14 (3.70)

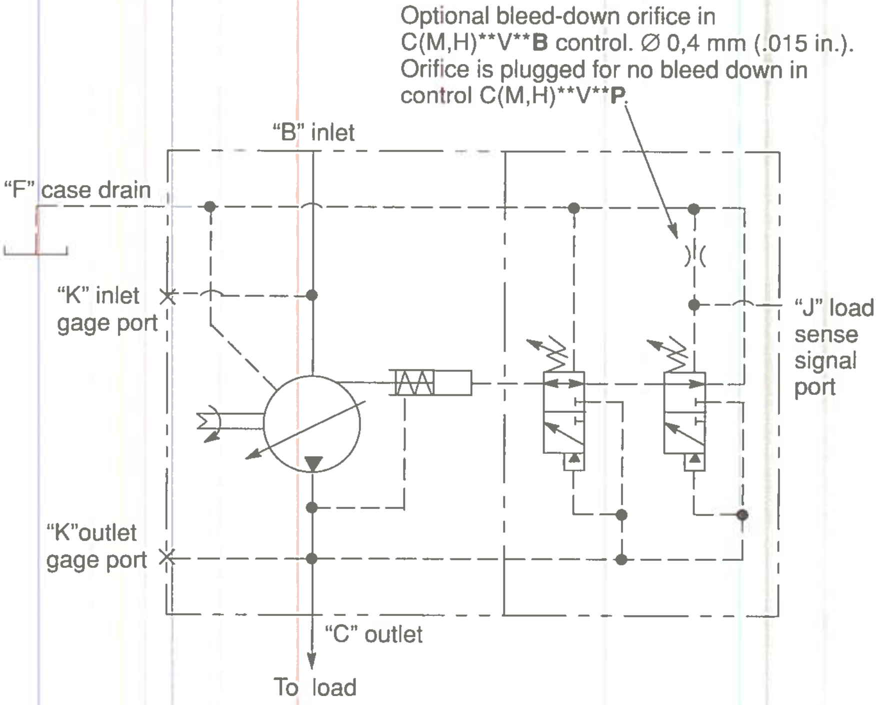
C(M)**V Load Sensing and Pressure Compensator Control

The pump will provide power matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load.

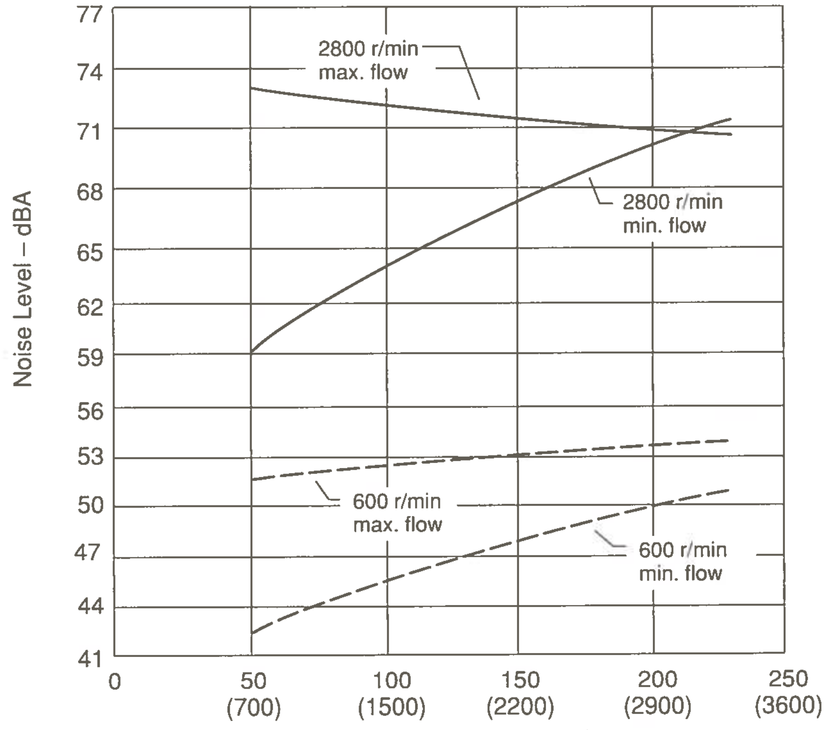
Load sensing ensures that the pump always provides only the amount of flow needed by the load. At the same time, the pump operating pressure adjusts to the actual load pressure plus a pressure differential required for the control action. When the system is not demanding power, the load sense control will operate in an energy-saving stand-by mode.

Typically, the differential pressure is that between the pressure inlet and service port of a proportionally controlled directional valve, or a load sensing directional control valve. See the model code on page 5 for differential pressure settings for load sensing.

If the load pressure exceeds the system pressure setting, the pressure compensator de-strokes the pump. The load sensing line must be as short as possible and can also be used for remote control or unloading of the pump pressure. For remote control purposes, it is recommended that you contact your Vickers representative for the correct configuration of the control.

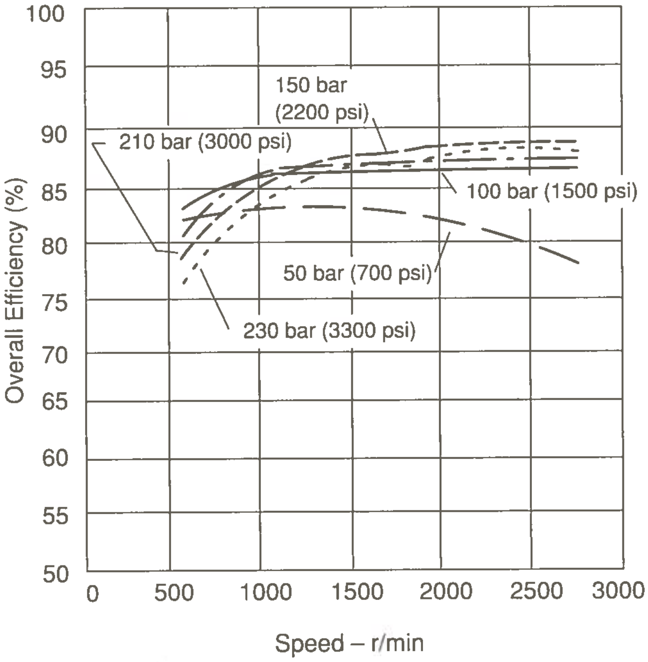

Optional bleed-down orifice in C(M,H)**V**B control. Ø 0,4 mm (.015 in.). Orifice is plugged for no bleed down in control C(M,H)**V**P.
"B" inlet
"F" case drain
"K" inlet gage port
"J" load sense signal port
"K"outlet gage port
"C" outlet
To load

Typical Noise Levels at 2800 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

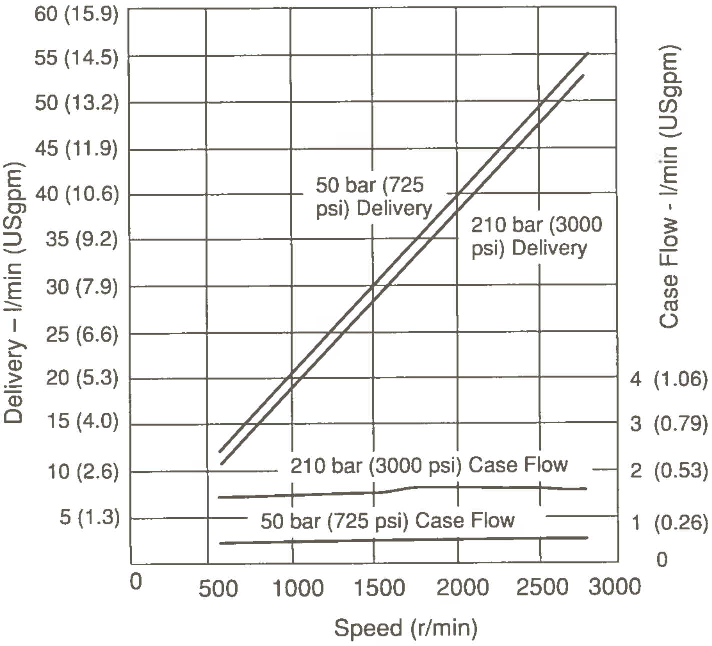


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet

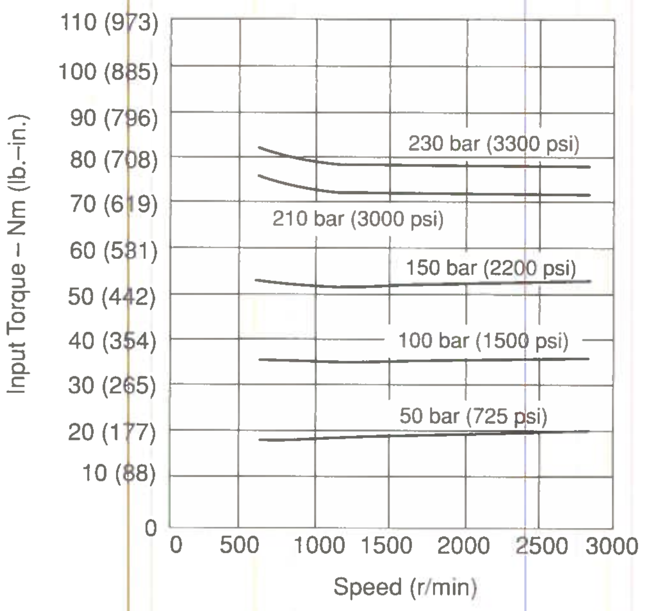


Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) inlet

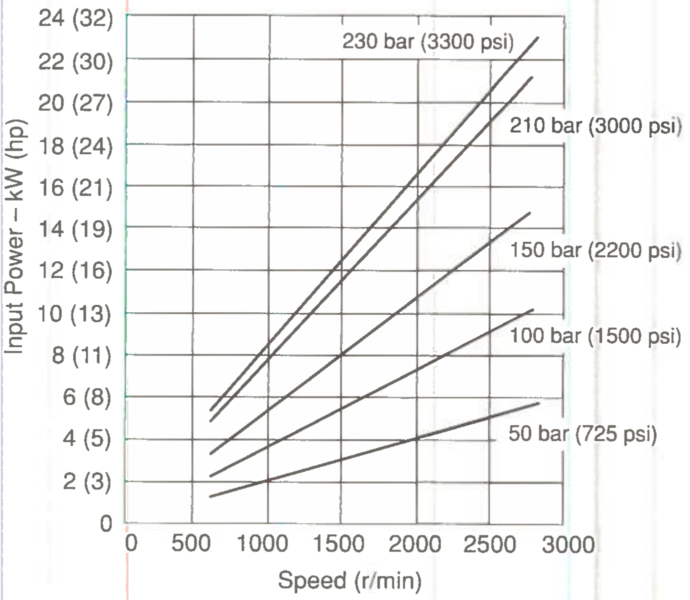


PVQ20 Performance

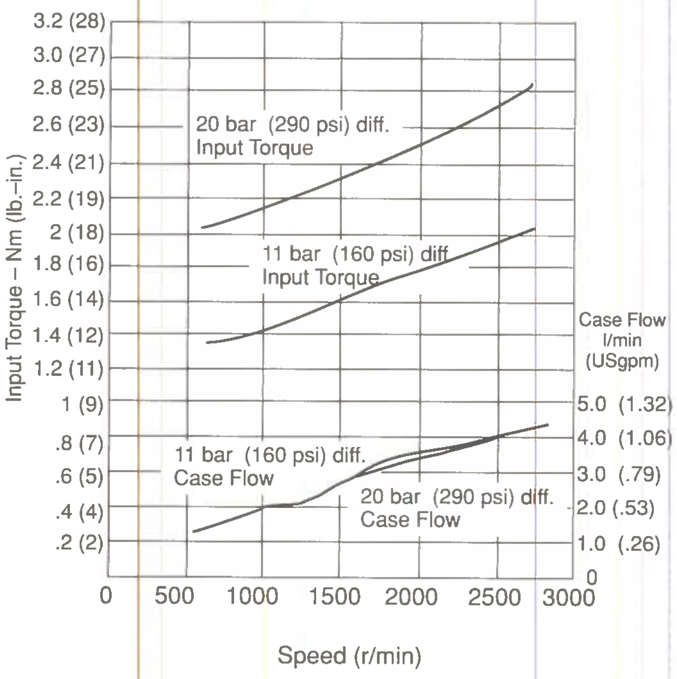
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



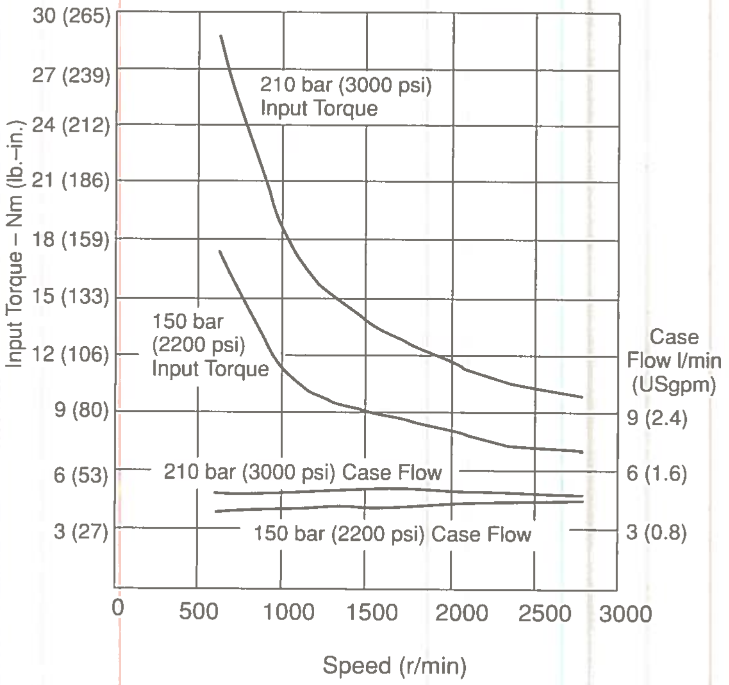
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



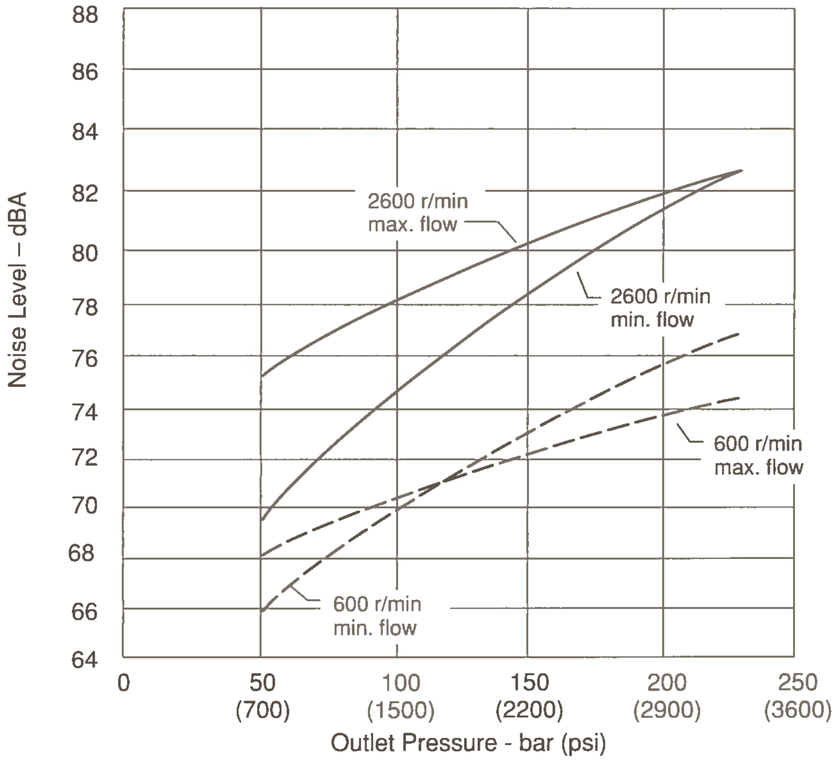
Input Torque and Case Flow versus Speed at 93° (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet

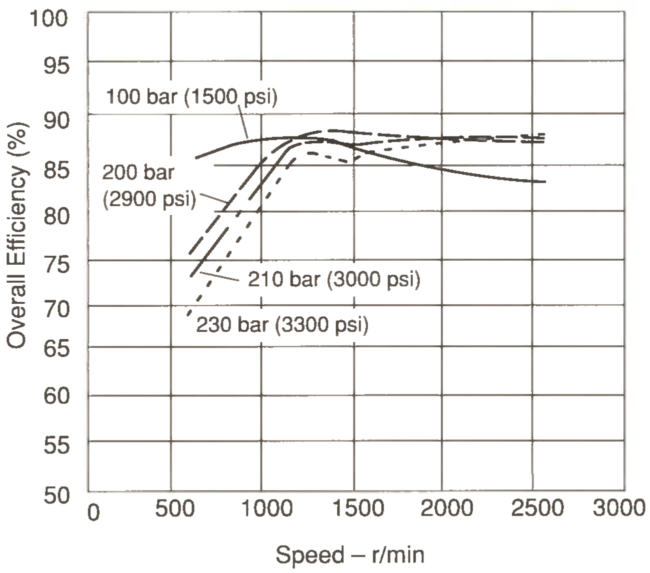


Typical Noise Levels at 2600 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet

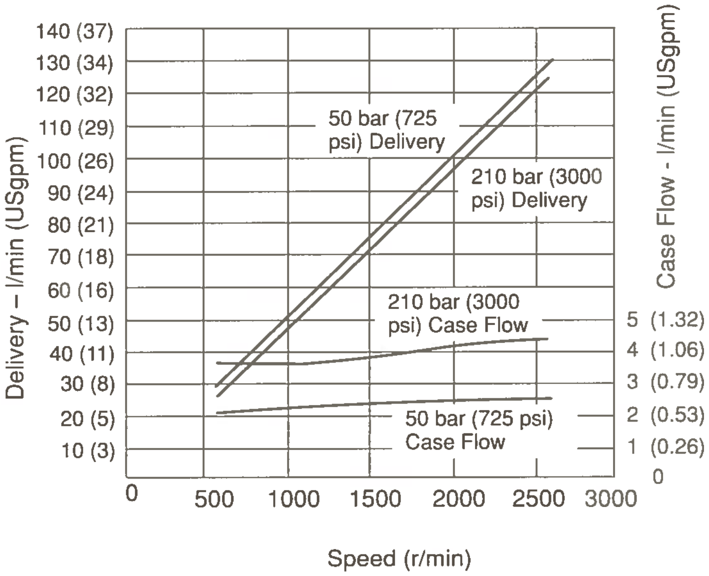


Sound pressure data equivalent to NFPA.

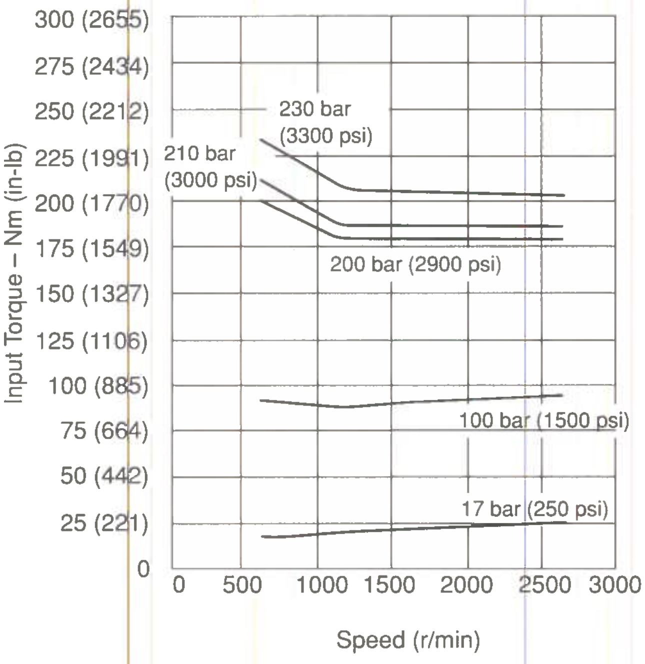
Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



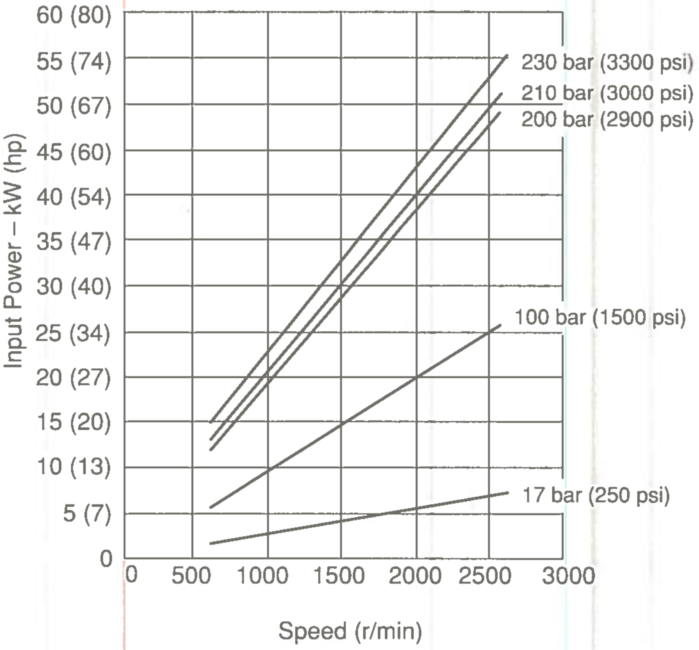
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) inlet



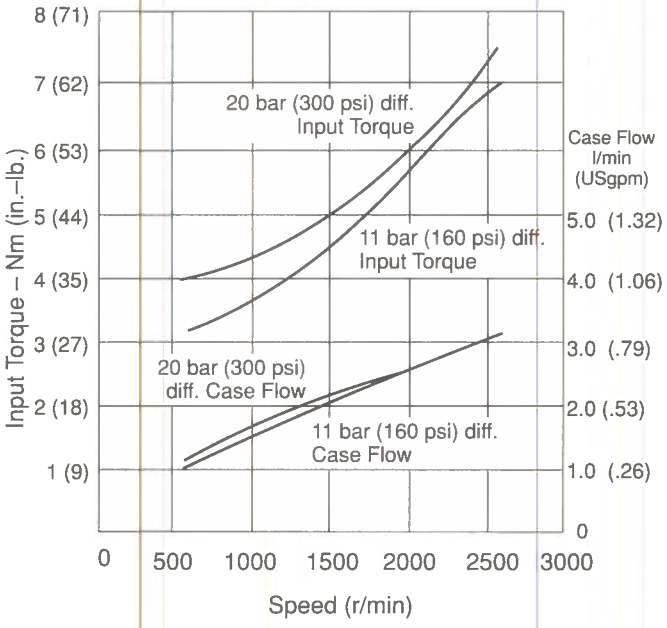
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



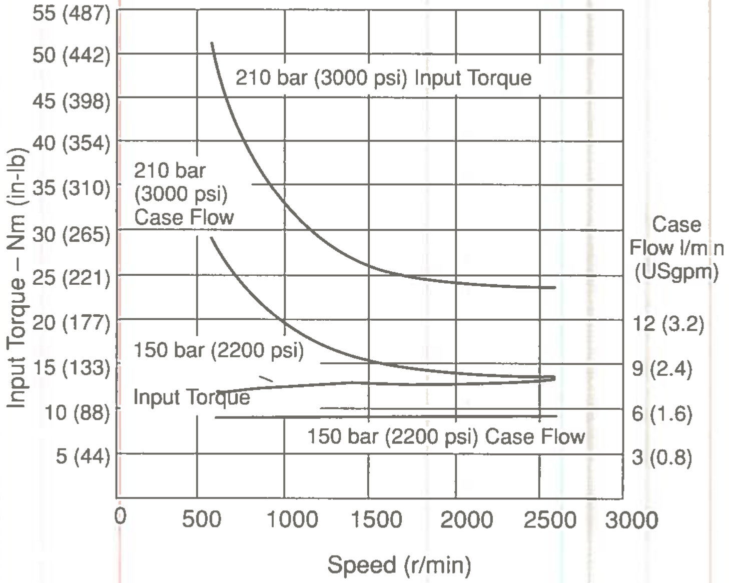
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



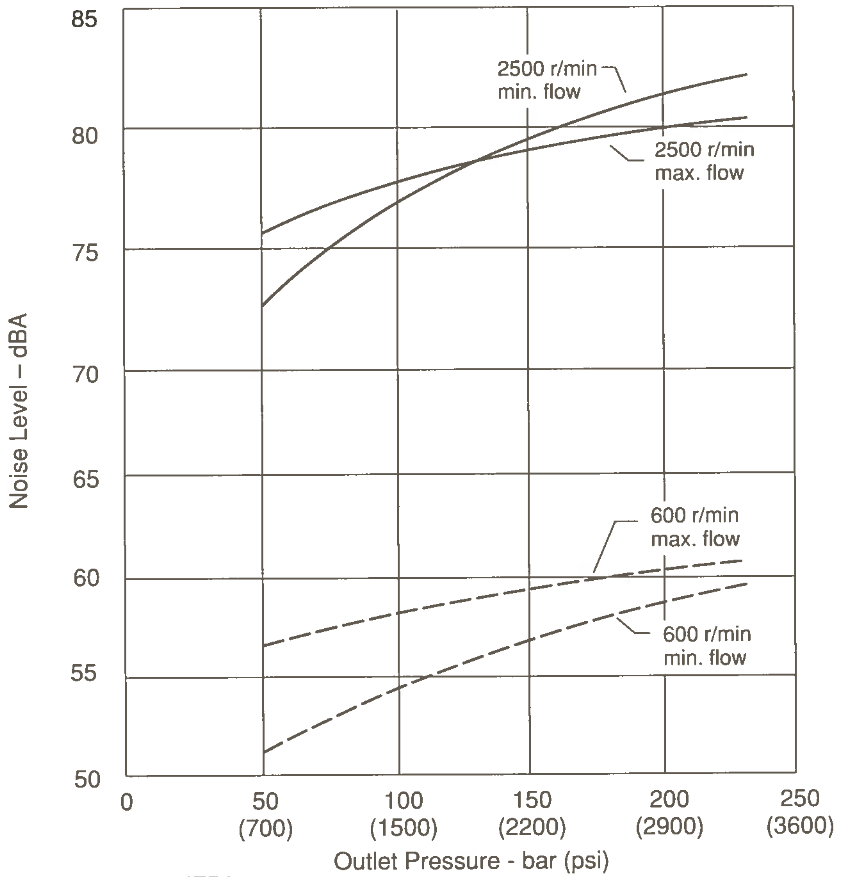
Input Torque and Case Flow versus Speed at 93° (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet

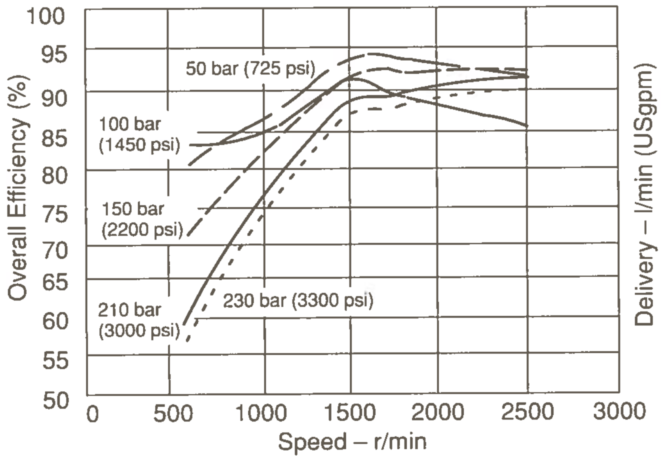


Typical Noise Levels at 2500 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

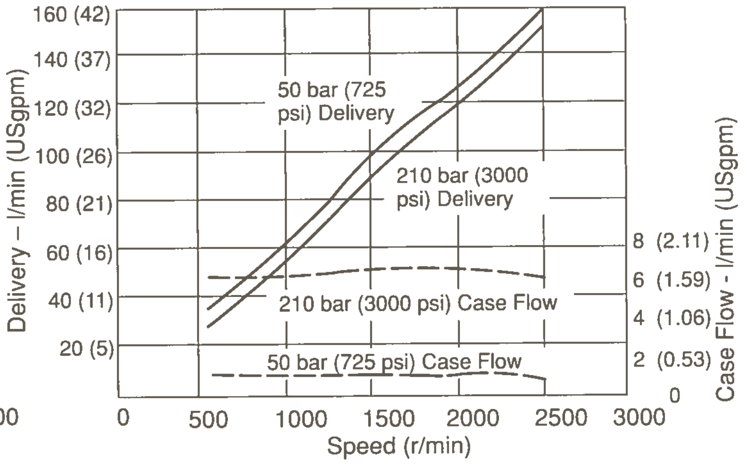


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet

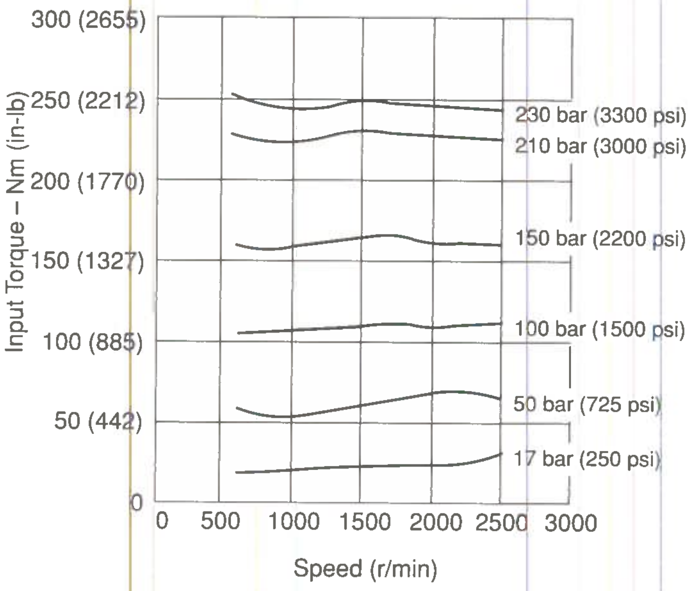


Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet

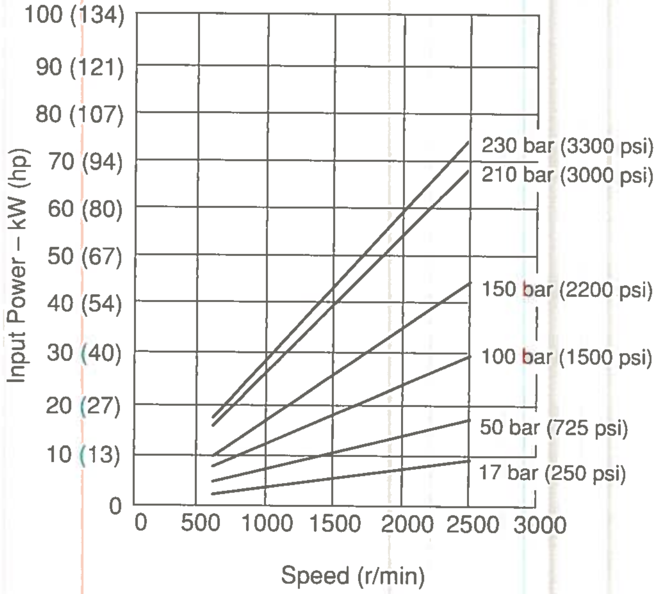


PVQ63 Performance

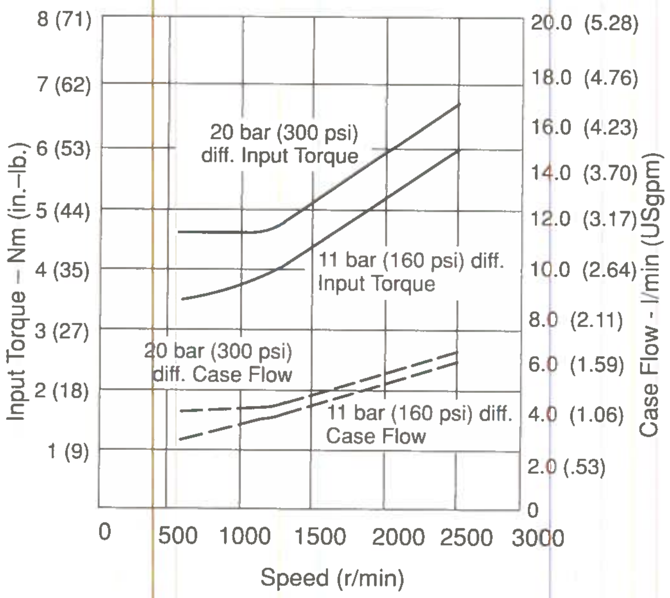
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



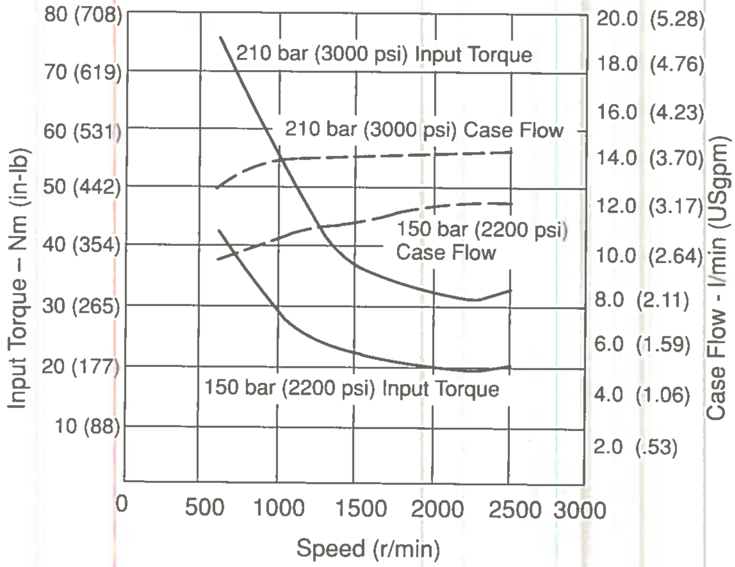
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



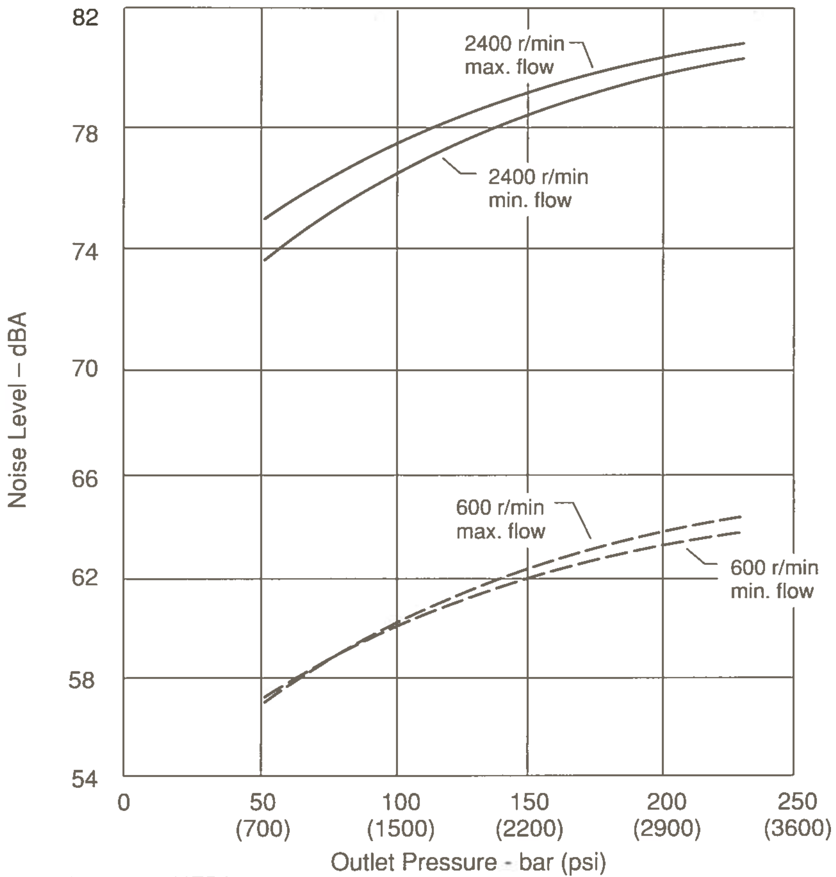
Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet

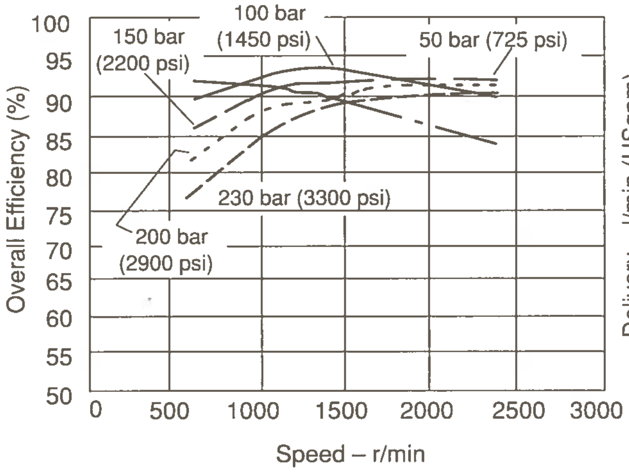


Typical Noise Levels at 2400 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

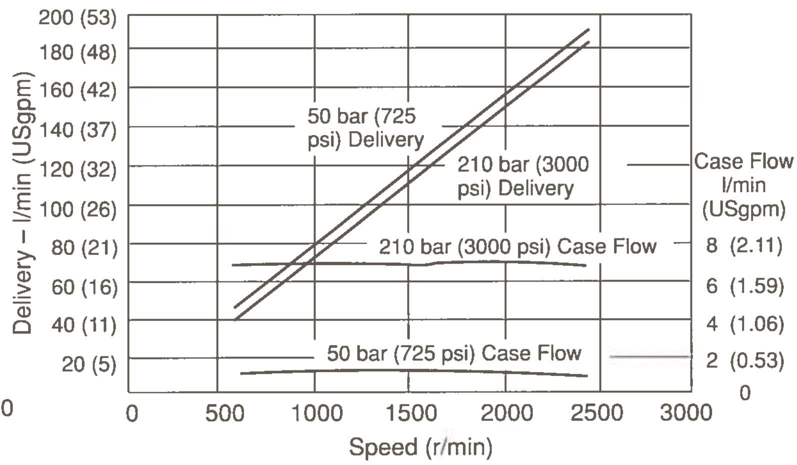


Sound pressure data equivalent to NFPA.

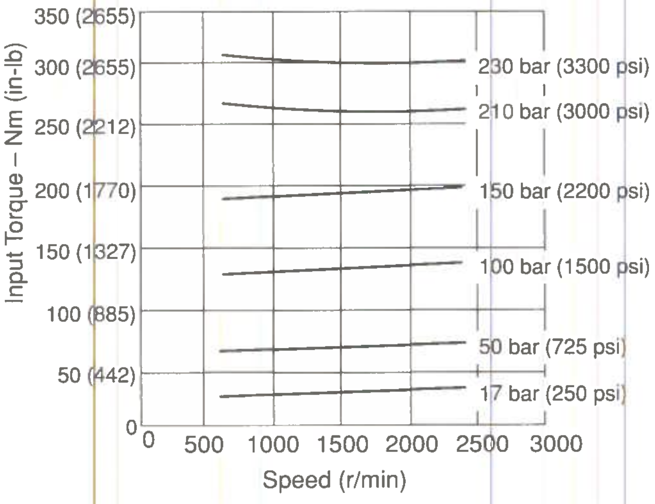
Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



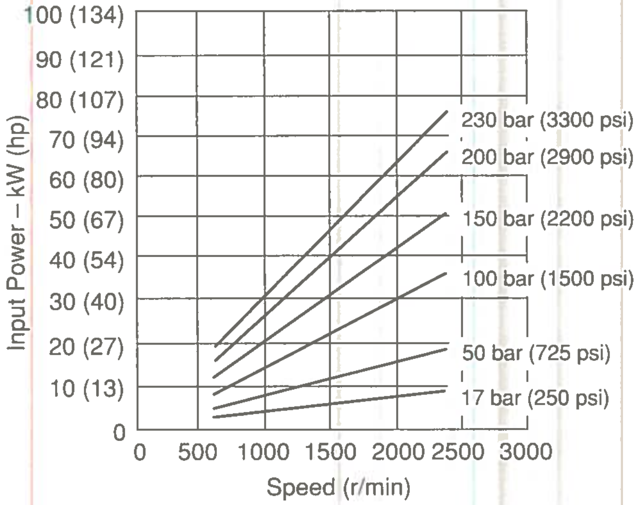
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet



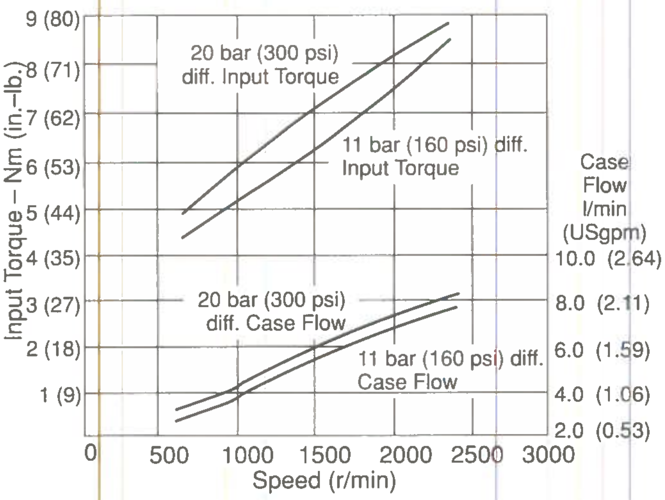
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



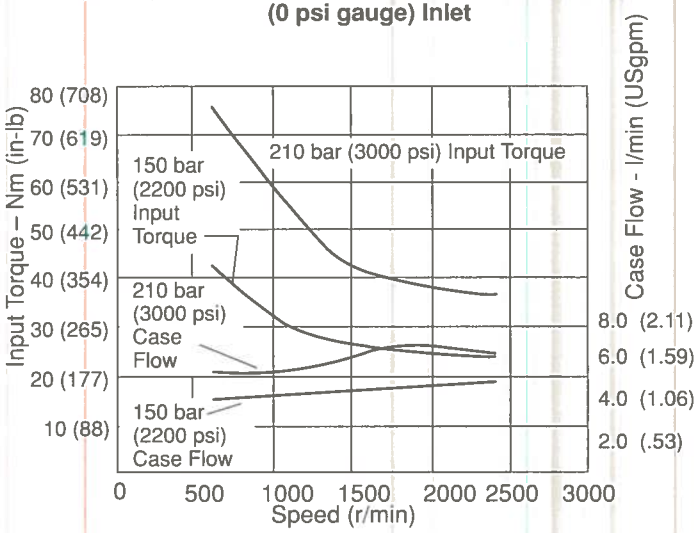
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



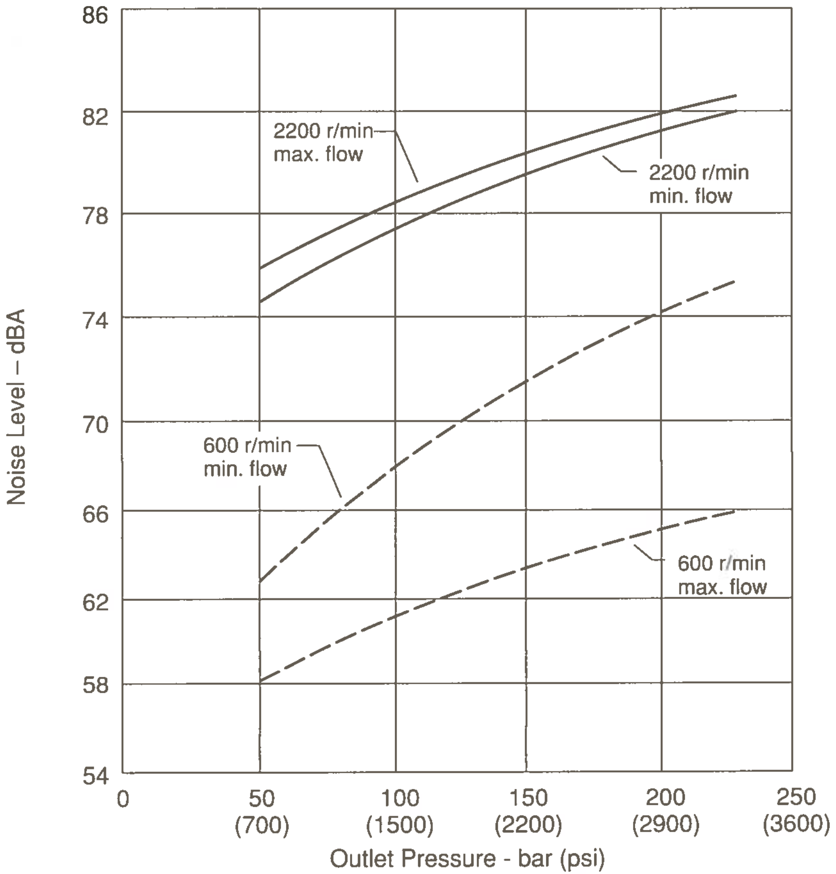
Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet

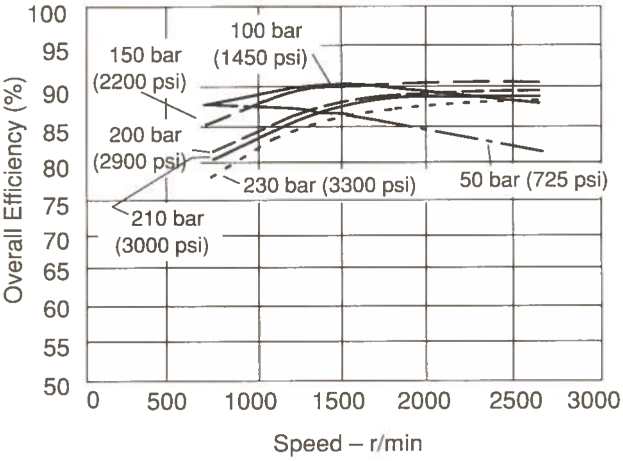


Typical Noise Levels at 2200 & 600 r/min with Petroleum Oil (10W) at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) Inlet

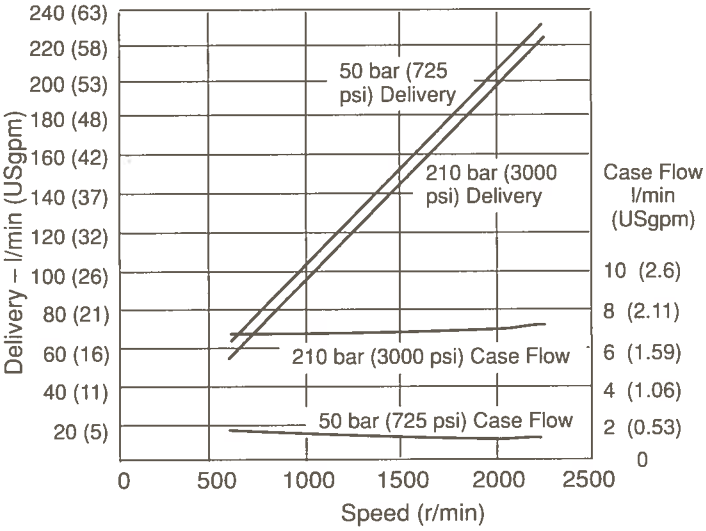


Sound pressure data equivalent to NFPA.

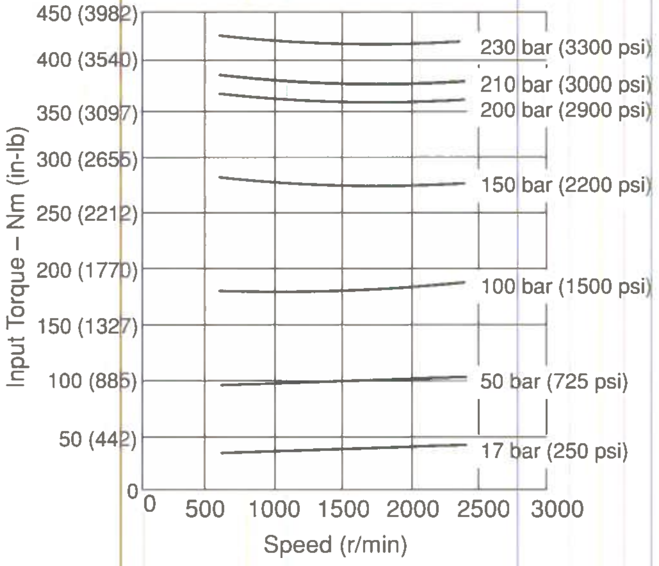
Overall Efficiency versus Speed at 93°C (200°F) and 1.0 bar absolute (0 psi gauge) inlet



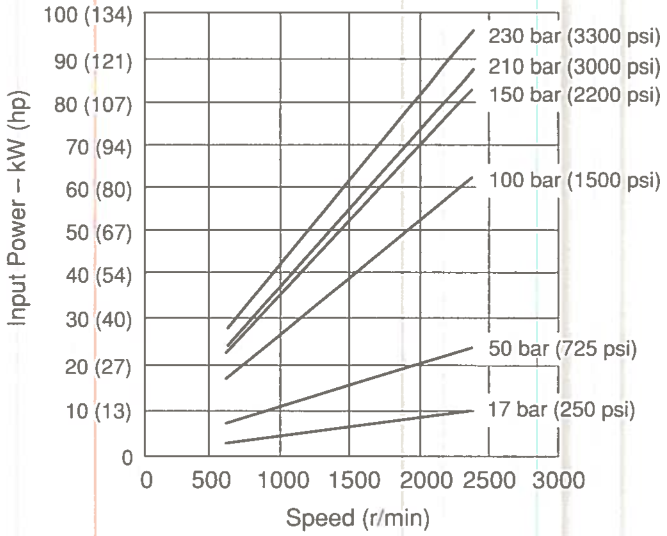
Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow 1.0 bar absolute (0 psi gauge) Inlet



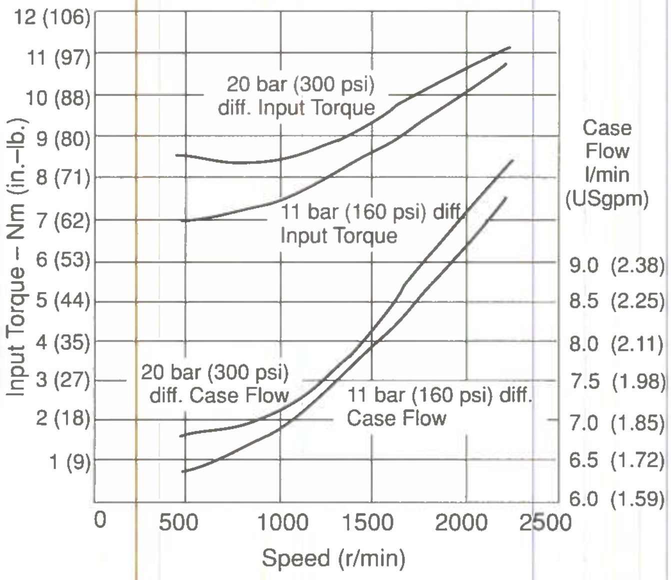
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



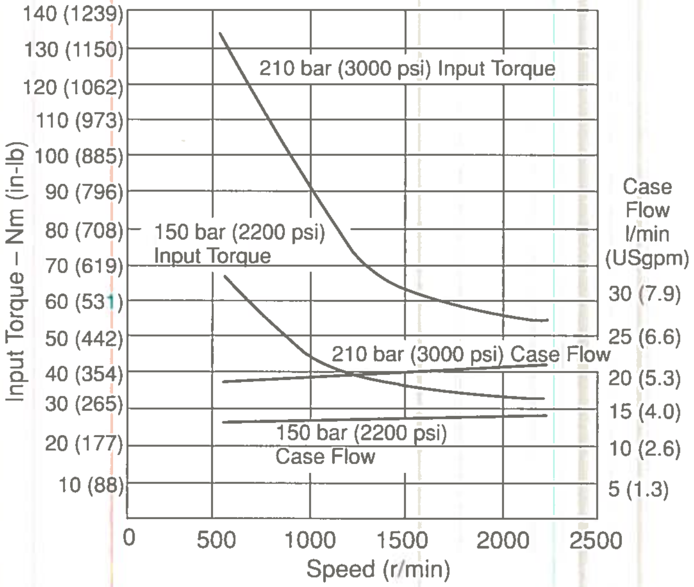
Input Power versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



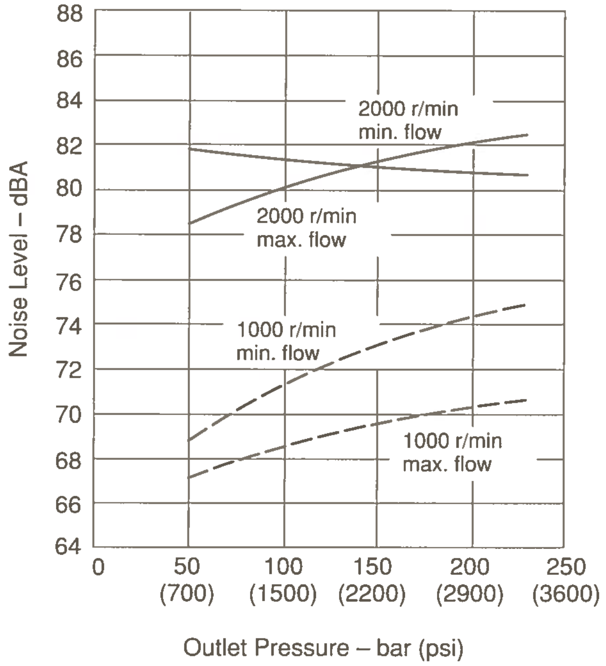
Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet



Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-off and 1.0 bar absolute (0 psi gauge) Inlet

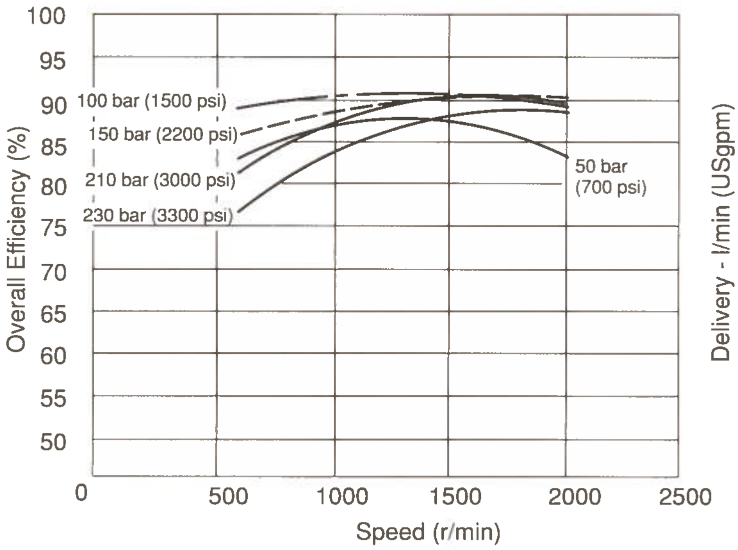


Typical Noise Levels at 2000 and 1000 r/min with Petroleum Oil (10W) at 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet

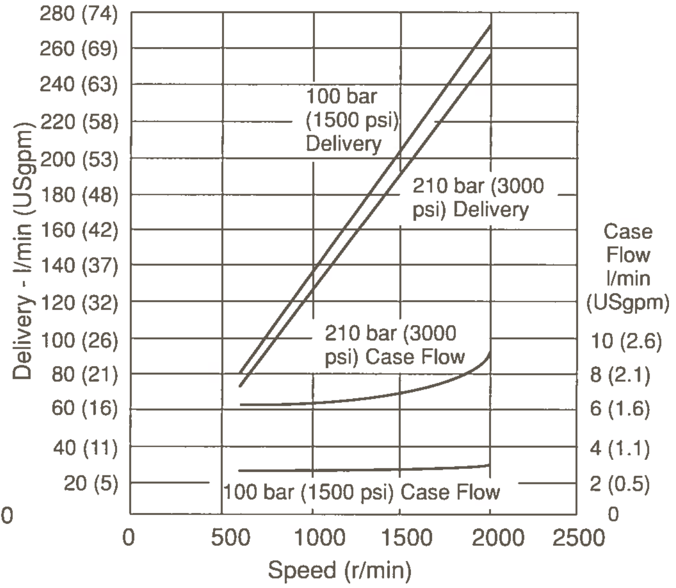


Sound pressure data equivalent to NFPA.

Overall Efficiency versus Speed at 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet

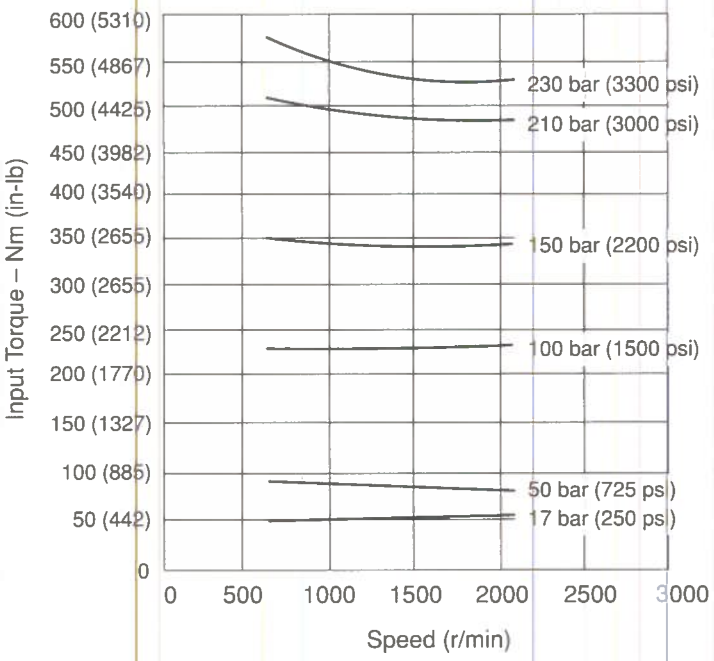


Delivery and Case Flow versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet

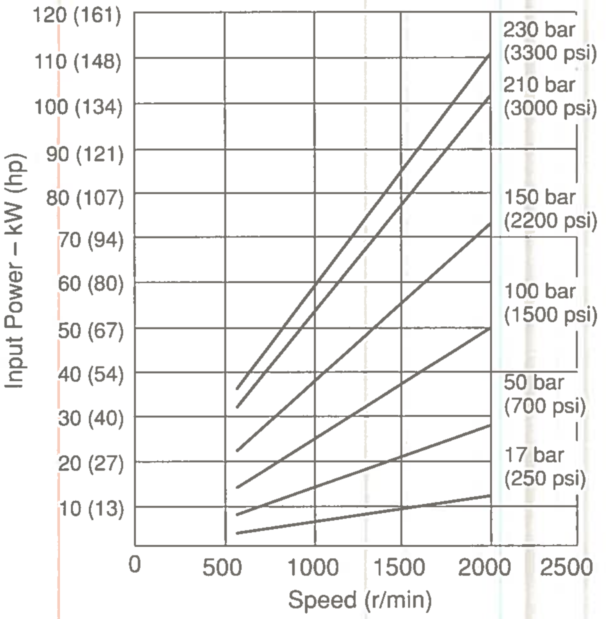


PVQ141 Performance

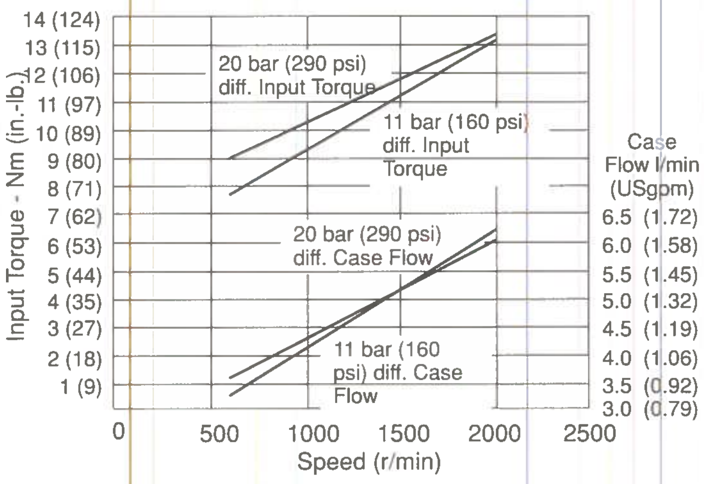
Input Torque versus Speed at 93°C (200°F), Full Flow and 1.0 bar absolute (0 psi gauge) Inlet



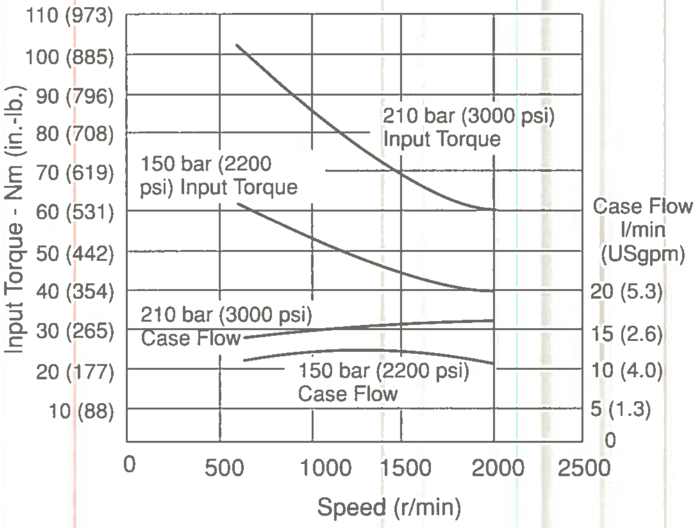
Input Power versus Speed, 93°C (200°F), and 1.0 bar absolute (0 psi gauge) Inlet



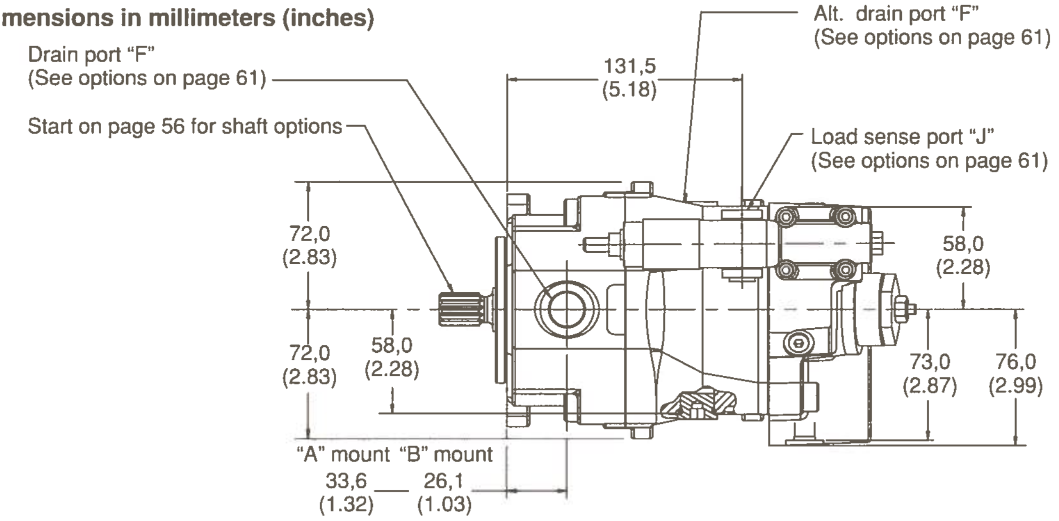
Input Torque and Case Flow versus Speed at 93°C (200°F), Load Sense Standby and 1.0 bar absolute (0 psi gauge) Inlet

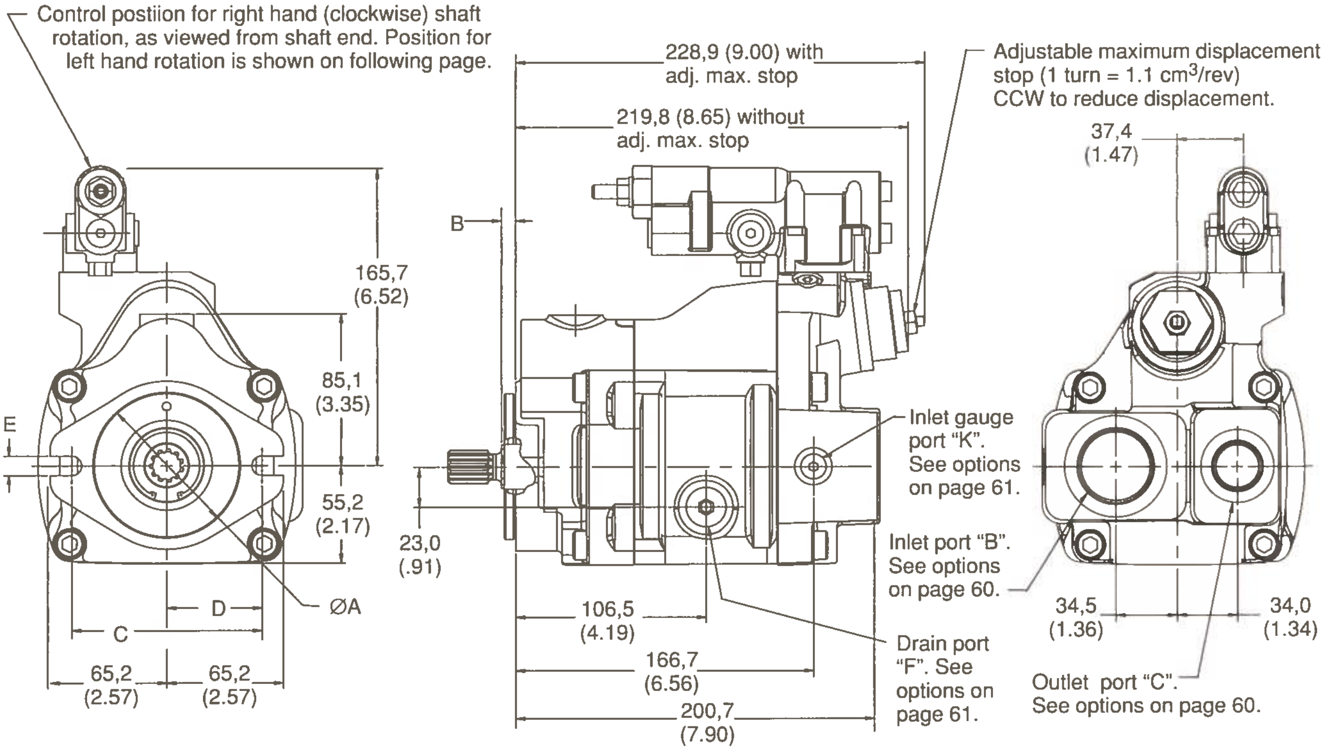


Input Torque and Case Flow versus Speed at 93°C (200°F), Pressure Limit Cut-Off and 1.0 bar absolute (0 psi gauge) Inlet



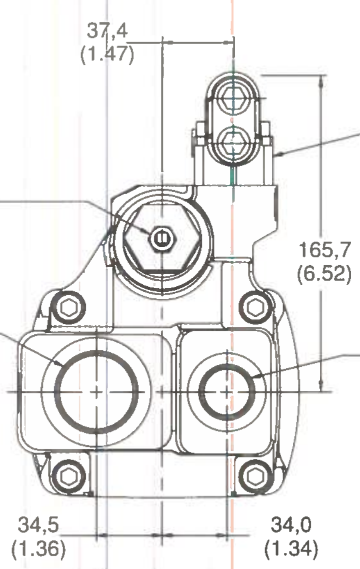
Dimensions in millimeters (inches)




Control postiion for right hand (clockwise) shaft rotation, as viewed from shaft end. Position for left hand rotation is shown on following page.
228,9 (9.00) with adj. max. stop
219,8 (8.65) without adj. max. stop
Adjustable maximum displacement stop (1 turn = 1.1 cm³/rev) CCW to reduce displacement.
37,4
(1.47)
B
165,7
(6.52)
85,1
(3.35)
E
55,2
(2.17)
23,0
(.91)
D
ØA
C
65,2
(2.57)
65,2
(2.57)
Inlet gauge port "K". See options on page 61.
Inlet port "B". See options on page 60.
106,5
(4.19)
166,7
(6.56)
200,7
(7.90)
Drain port "F". See options on page 61.
34,5
(1.36)
34,0
(1.34)
Outlet port "C". See options on page 60.

"A" Pilot Flange Designation	**ØA**	**B**	**C**	**D**	**E**
SAE J744-82-2 Model Code "A2"	82,55 (3.25)	8,00 (.315)	106,4 (4.19)	53,2 (2.09)	11,35/10,97 (.447/.432)
ISO 3019/2-80A2HW Model Code "MA2"	80,00 (3.15)	8,00 (.315)	109,0 (4.29)	54,5 (2.15)	11,27/11,00 (.444/.433)
"B" Pilot Flange Designation					
SAE J744-101-2 Model Code "B2"	101,60 (4.00)	8,00 (.315)	146,0 (5.750)	73,0 (2.875)	14,55/14,17 (.572/.557)
ISO 3019/2-100A2HW Model Code "MB2"	100,00 (3.937)	8,00 (3.15)	140,0 (5.512)	70,0 (2.756)	14,27/14,00 (.562/.551)

Dimensions in millimeters (inches)



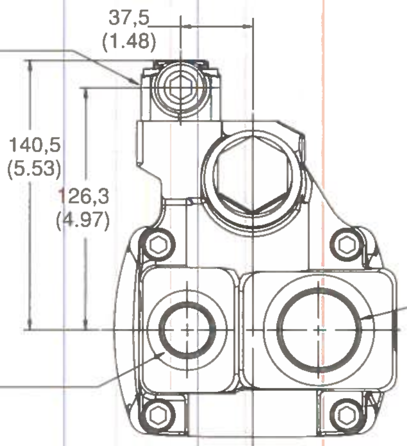
Control position for right hand rotation (Load sensing control shown)

Adjustable maximum displacement stop (1 turn = 1.1 cm^3/rev) CCW to destroke

Inlet position for right hand rotation (Position for left hand rotation shown below)

Outlet

Inlet/Outlet Ports and Control Positioned for *Right Hand Rotation*



Control position for left hand rotation (Pressure compensated control shown)

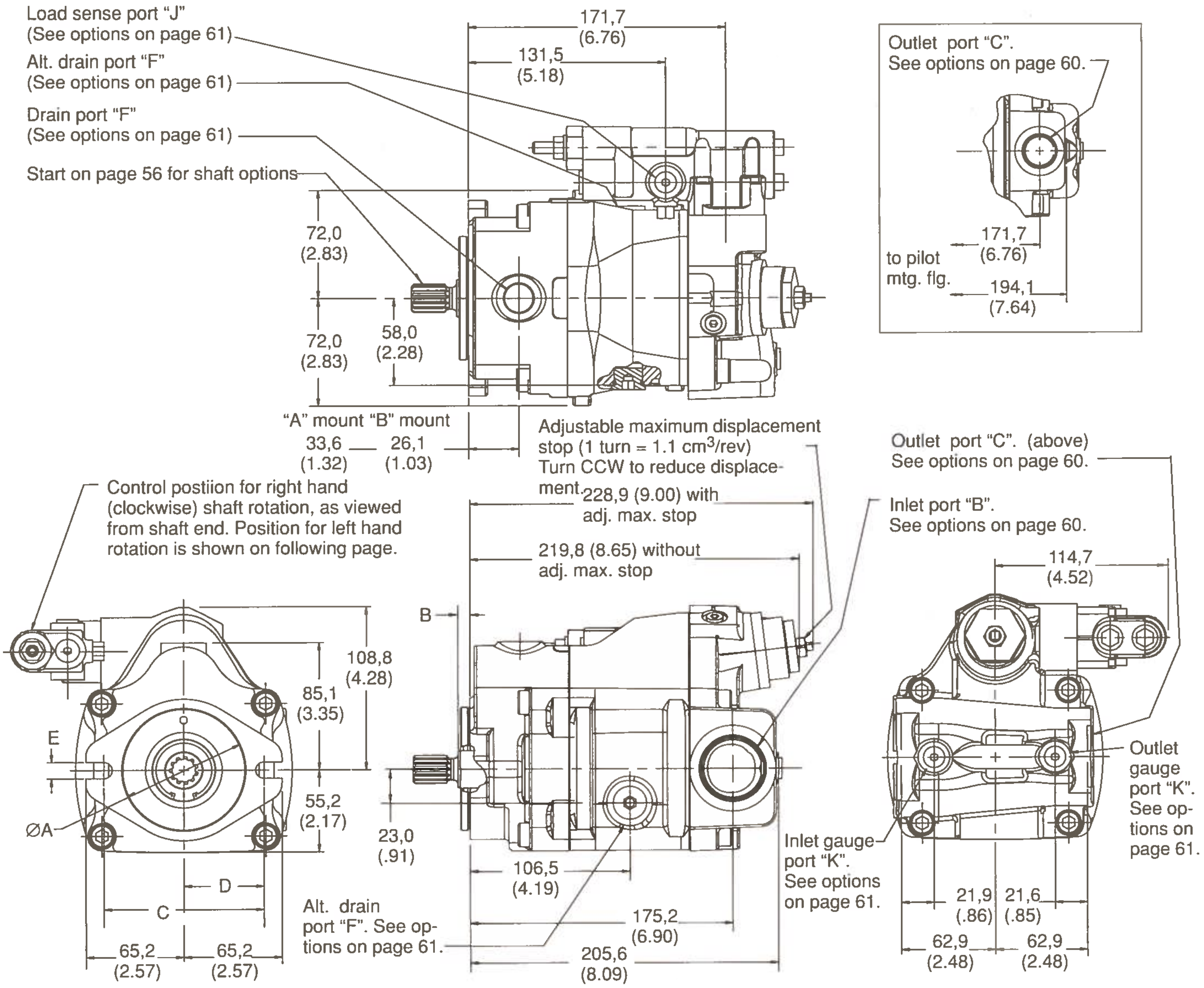
Inlet position for left hand rotation (Position for right hand rotation shown above)

Outlet

Inlet/Outlet Ports and Control Positioned for *Left Hand Rotation*

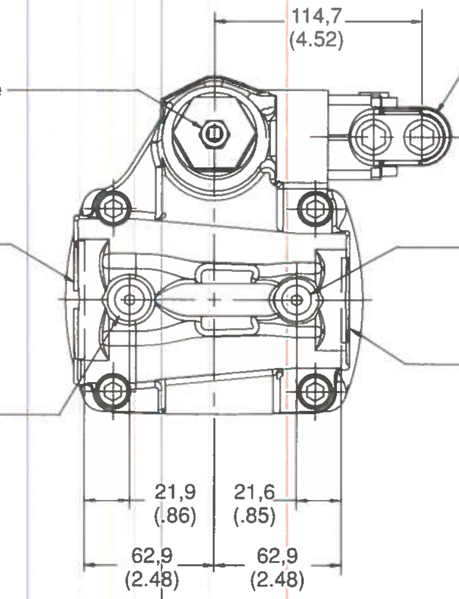
PVQ20 Side-ported Models

Dimensions in millimeters (inches)


Load sense port "J" (See options on page 61)
Alt. drain port "F" (See options on page 61)
Drain port "F" (See options on page 61)
Start on page 56 for shaft options
171,7 (6.76)
131,5 (5.18)
72,0 (2.83)
72,0 (2.83)
58,0 (2.28)
"A" mount "B" mount
33,6 (1.32)
26,1 (1.03)
Outlet port "C". See options on page 60.
171,7 (6.76)
to pilot mtg. flg.
194,1 (7.64)
Adjustable maximum displacement stop (1 turn = 1.1 cm³/rev) Turn CCW to reduce displacement.
228,9 (9.00) with adj. max. stop
219,8 (8.65) without adj. max. stop
Control postiion for right hand (clockwise) shaft rotation, as viewed from shaft end. Position for left hand rotation is shown on following page.
Outlet port "C". (above) See options on page 60.
Inlet port "B". See options on page 60.
114,7 (4.52)
B
108,8 (4.28)
85,1 (3.35)
E
55,2 (2.17)
ØA
23,0 (.91)
D
C
65,2 (2.57)
65,2 (2.57)
Alt. drain port "F". See options on page 61.
106,5 (4.19)
175,2 (6.90)
205,6 (8.09)
Inlet gauge port "K". See options on page 61.
Outlet gauge port "K". See options on page 61.
21,9 (.86)
21,6 (.85)
62,9 (2.48)
62,9 (2.48)

"A" Pilot Flange Designation	ØA	B	C	D	E
SAE J744-82-2 Model Code "A2"	82,55 (3.25)	8,00 (.315)	106,4 (4.19)	53,2 (2.09)	11,35/10,97 (.447/.432)
ISO 3019/2-80A2HW Model Code "MA2"	80,00 (3.15)	8,00 (.315)	109,0 (4.29)	54,5 (2.15)	11,27/11,00 (.444/.433)
"B" Pilot Flange Designation					
SAE J744-101-2 Model Code "B2"	101,60 (4.00)	8,00 (.315)	146,0 (5.750)	73,0 (2.875)	14,55/14,17 (.572/.557)
ISO 3019/2-100A2HW Model Code "MB2"	100,00 (3.937)	8,00 (3.15)	140,0 (5.512)	70,0 (2.756)	14,27/14,00 (.562/.551)

Dimensions in millimeters (inches)



Adjustable maximum displacement stop (1 turn = 1.1 cm^3/rev) Turn CCW to destroke

Control position for right hand rotation (Load sensing control shown)

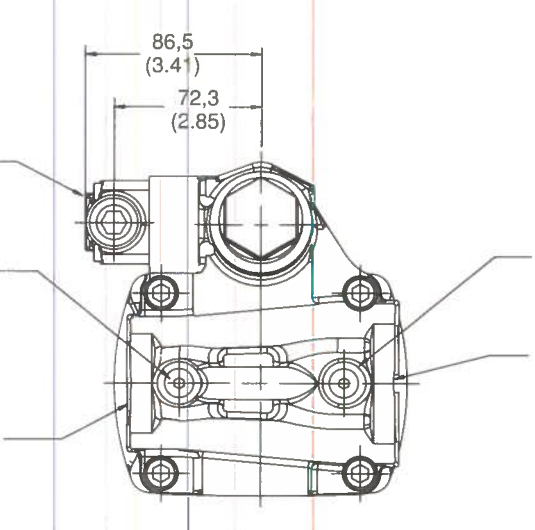
Inlet position for right hand rotation (Position for lef hand rotation shown below)

Outlet gauge port "K". See options on page 61.

Outlet

Inlet gauge port "K". See options on page 61.

Inlet/Outlet Ports and Control Positioned for *Right Hand Rotation*



Control position for left hand rotation (Pressure compensated control shown)

Outlet gauge port "K". See options on page 61.

Outlet

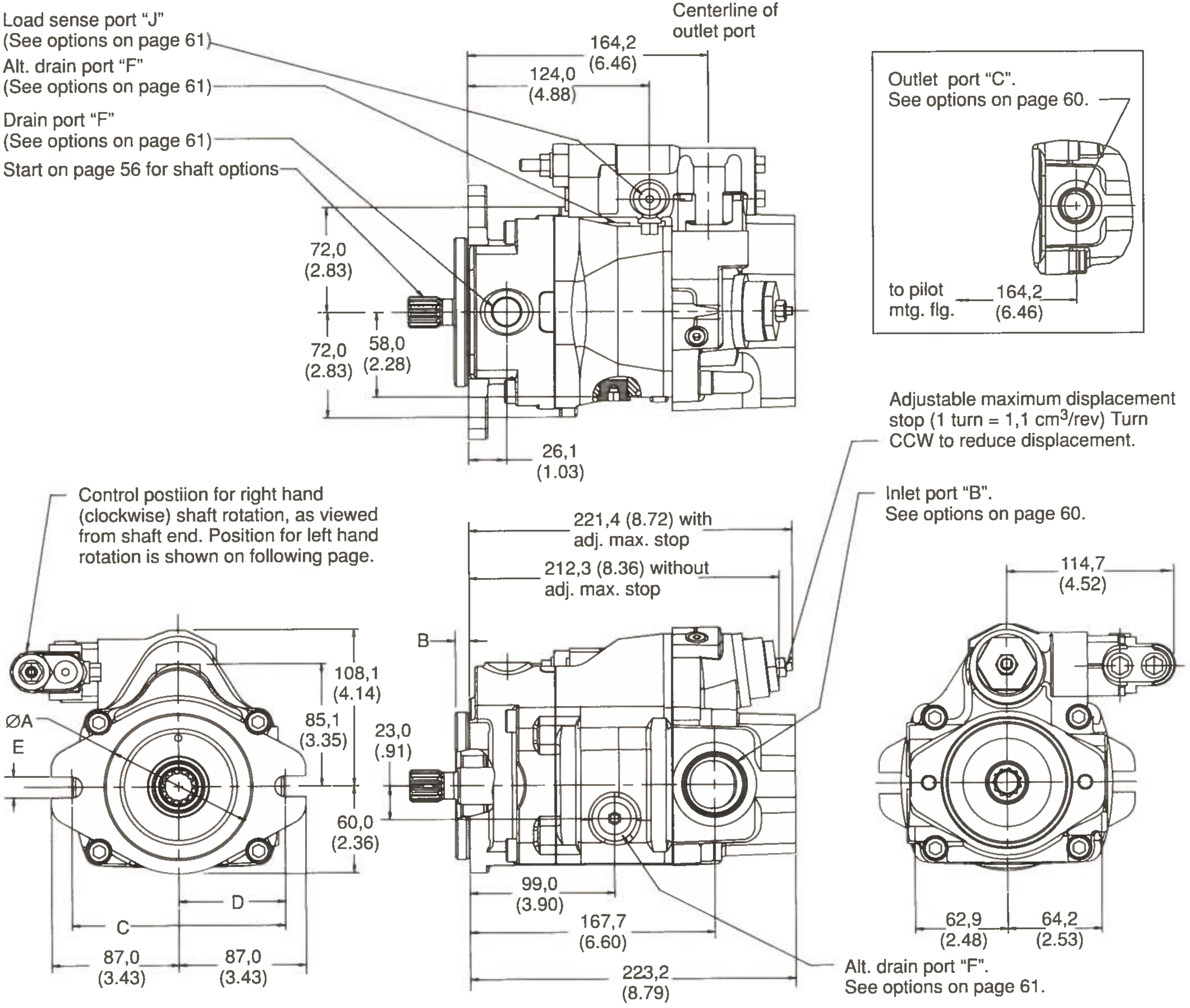
Inlet gauge port "K". See options on page 61.

Inlet position for left hand rotation (Position for right hand rotation shown above)

Inlet/Outlet Ports and Control Positioned for *Left Hand Rotation*

PVQ20 Thru-drive Models

Dimensions in millimeters (inches)



Load sense port “J” (See options on page 61)

Alt. drain port “F” (See options on page 61)

Drain port “F” (See options on page 61)

Start on page 56 for shaft options

Centerline of outlet port

Outlet port “C”. See options on page 60.

Adjustable maximum displacement stop (1 turn = 1,1 cm^3/rev) Turn CCW to reduce displacement.

Control postiion for right hand (clockwise) shaft rotation, as viewed from shaft end. Position for left hand rotation is shown on following page.

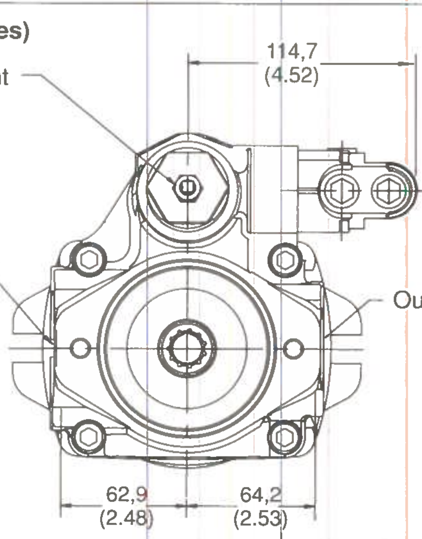
Inlet port “B”. See options on page 60.

Alt. drain port “F”. See options on page 61.

“B” Pilot Flange Designation	ØA	B	C	D	E
SAE J744-101-2 Model Code “B2”	101,60 (4.00)	8,00 (.315)	146,0 (5.75)	73,0 (2.87)	14,55/14,17 (.572/.558)
ISO 3019/2-100 A2HW Model Code “MB2”	100,00 (3.94)	8,00 (.315)	140,0 (5.51)	70,0 (2.76)	14,27/14,00 (.562/.551)

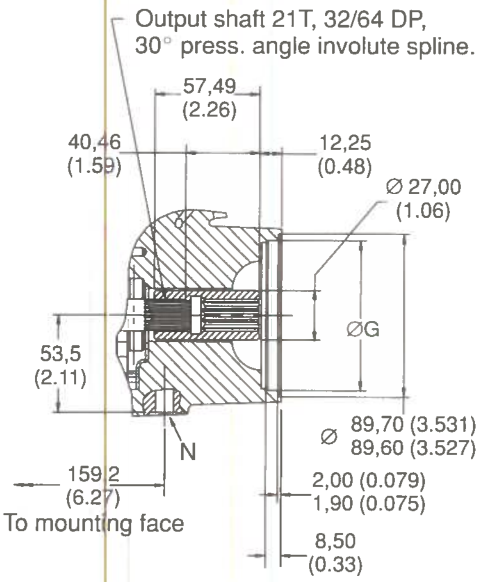
PVQ20 Thru-drive Models

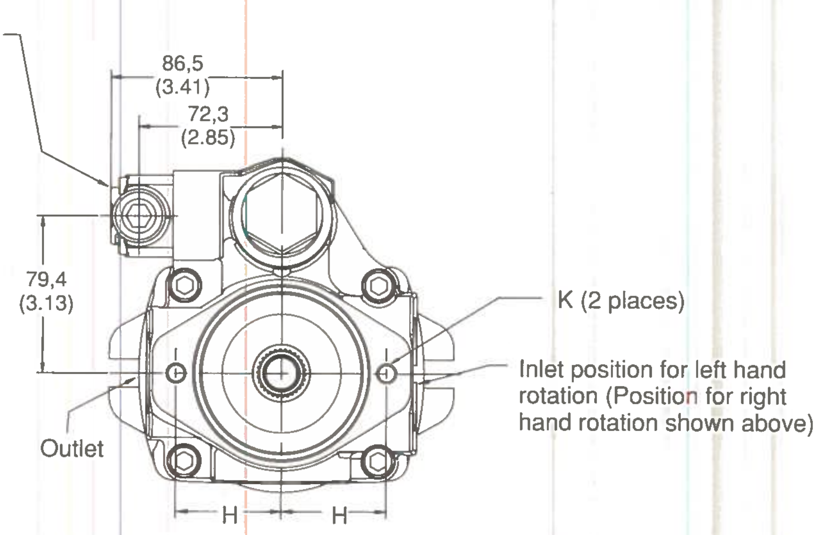
Dimensions in millimeters (inches)


Adjustable maximum displacement stop (1 turn = 1,1 cm³/rev). Turn CCW to reduce displacement.
114,7 (4.52)
Control position for right hand rotation (Load sensing control shown)
Inlet position for right hand rotation (Position for lef hand rotation shown below)
Outlet
62,9 (2.48)
64,2 (2.53)

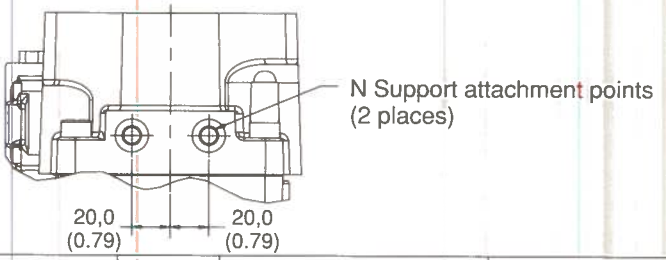
Inlet/Outlet Ports and Control Positioned for *Right Hand Rotation*

Coupling Code	Description
A9	For SAE "A" pad with a 9T, 16/32 DP, 30° Press. angle, involute spline.
A11	For SAE "A" pad with a 11T, 16/32 DP, 30° Press. angle, involute spline.
MA9	For ISO 80 A2HW pad with 9T, 16/32 DP, 30° Press. angle, involute spline.
MA11	For ISO 80 A2HW pad with a 11T, 16/32 DP, 30° Press. angle, involute spline.


Output shaft 21T, 32/64 DP, 30° press. angle involute spline.
57,49 (2.26)
40,46 (1.59)
12,25 (0.48)
Ø 27,00 (1.06)
ØG
53,5 (2.11)
Ø 89,70 (3.531) 89,60 (3.527)
N
159,2 (6.27) To mounting face
2,00 (0.079) 1,90 (0.075)
8,50 (0.33)


Control position for left hand rotation (Pressure compensator control shown)
86,5 (3.41)
72,3 (2.85)
79,4 (3.13)
K (2 places)
Inlet position for left hand rotation (Position for right hand rotation shown above)
Outlet
H
H

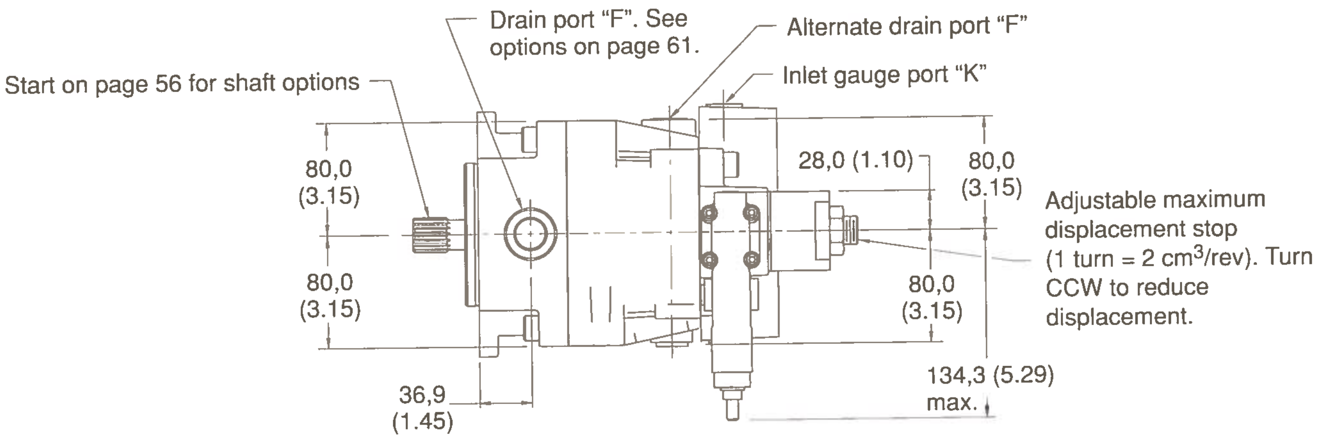
Inlet/Outlet Ports and Control Positioned for *Left Hand Rotation*

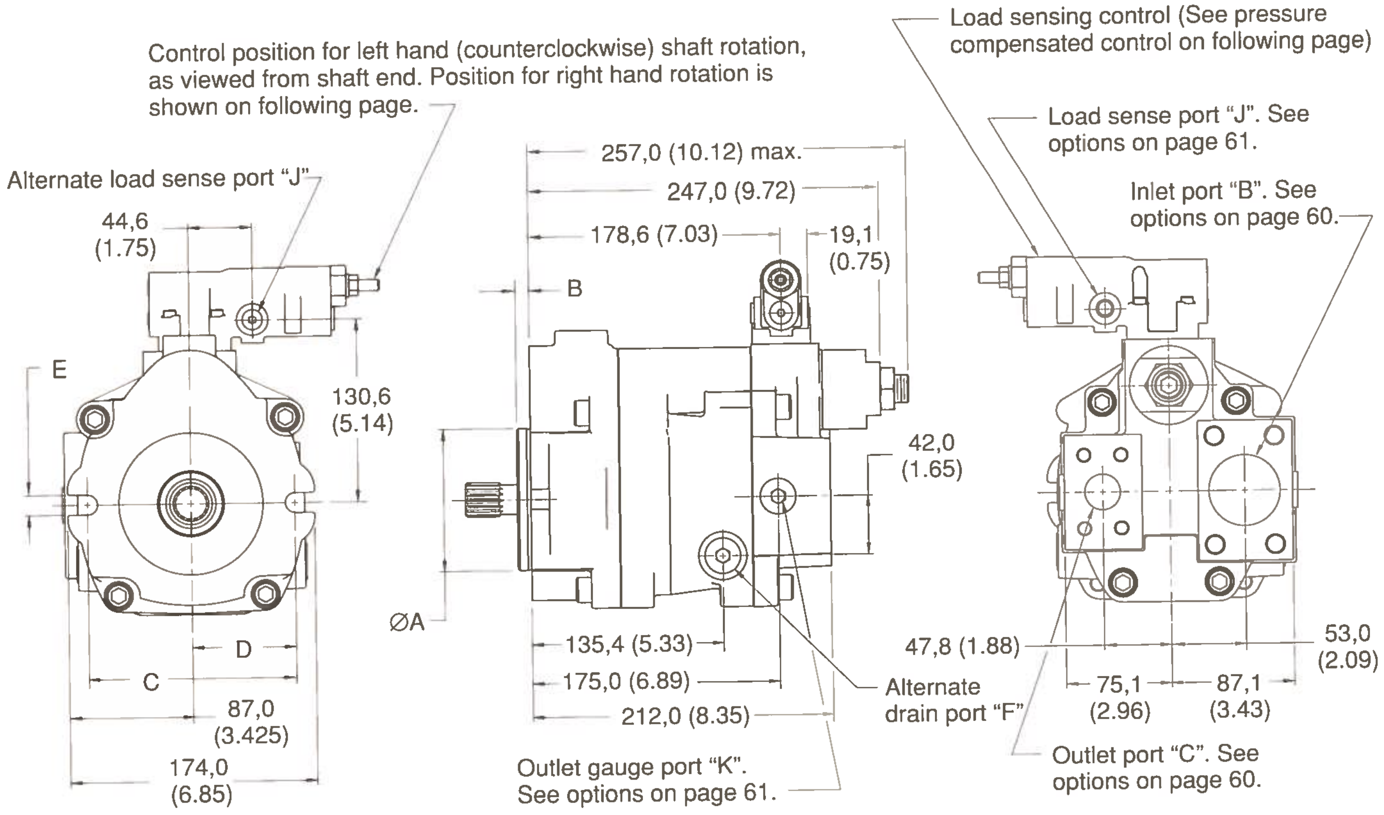


Thru-drive Flange Designation	Port Code	ØG	H	K	N
SAE "A" Pad	F, S	82,625 (3.253) 82,575 (3.250)	53,2 (2.09)	.375-16 UNC-2B thd 0.75 deep min	.375-16 UNC-2B thd 0.62 deep min
	D, M, B	82,625 (3.253) 82,575 (3.250)	53,2 (2.09)	M10 x 1,50 thd 19,05 deep min	M10 x 1,50 thd 15,88 deep min
ISO 80-A2HW Pad	D, M, B	80,046 (3.15) 80,002 (3.149)	54,5 (2.15)	M10 thd x 19,05 deep min	M10 thd x 15,88 deep min

PVQ50 End-ported Models

Dimensions in millimeters (inches)

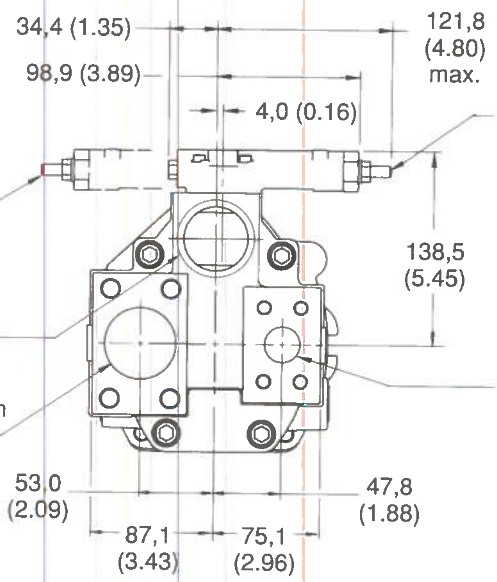

Drain port "F". See options on page 61.
Alternate drain port "F"
Inlet gauge port "K"
Start on page 56 for shaft options
80,0 (3.15)
80,0 (3.15)
28,0 (1.10)
80,0 (3.15)
Adjustable maximum displacement stop (1 turn = 2 cm³/rev). Turn CCW to reduce displacement.
80,0 (3.15)
134,3 (5.29) max.
36,9 (1.45)


Control position for left hand (counterclockwise) shaft rotation, as viewed from shaft end. Position for right hand rotation is shown on following page.
Load sensing control (See pressure compensated control on following page)
Load sense port "J". See options on page 61.
Inlet port "B". See options on page 60.
Alternate load sense port "J"
44,6 (1.75)
E
130,6 (5.14)
D
C
87,0 (3.425)
174,0 (6.85)
257,0 (10.12) max.
247,0 (9.72)
178,6 (7.03)
19,1 (0.75)
B
42,0 (1.65)
ØA
135,4 (5.33)
175,0 (6.89)
212,0 (8.35)
Outlet gauge port "K". See options on page 61.
Alternate drain port "F"
47,8 (1.88)
53,0 (2.09)
75,1 (2.96)
87,1 (3.43)
Outlet port "C". See options on page 60.

Flange Designation	ØA	B	C	D	E
SAE J744-101-2	101,60/101,55 (4.000/3.998)	9,70/9,19 (.382/.362)	146,0 (5.750)	73,0 (2.875)	14,55/14,17 (.572/.557)
ISO 3019/2-100A2HW	100,00/99,95 (3.937/3.935)	9,50/9,00 (.374/.354)	140,0 (5.512)	70,0 (2.756)	14,27/14,00 (.562/.551)

PVQ50 End-ported Models

Dimensions in millimeters (inches)



Control position for left hand rotation

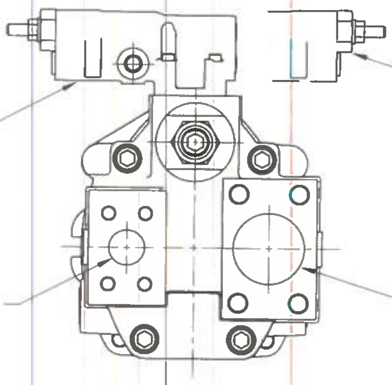
Non-maximum adjustment stop control cap. See preceding page for adjustable maximum displacement stop.

Inlet position for right hand rotation (Position for lef hand rotation shown below)

Control position for right hand rotation (Pressure compensated control shown)

Outlet

Inlet/Outlet Ports and Control Positioned for *Right Hand Rotation*



Control position for left hand rotation (Load sensing control shown)

Outlet

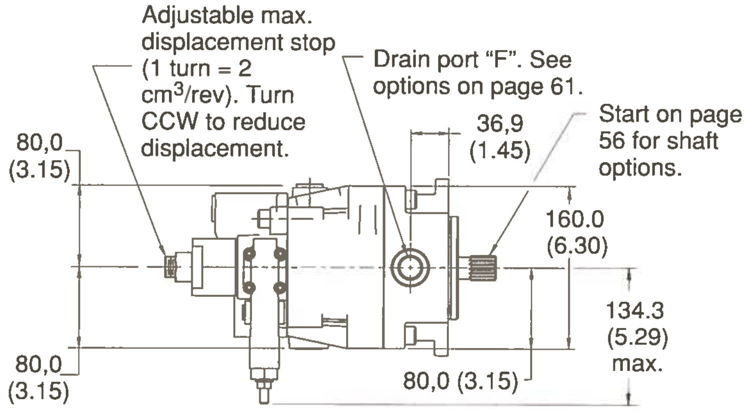
Control position for right hand rotation

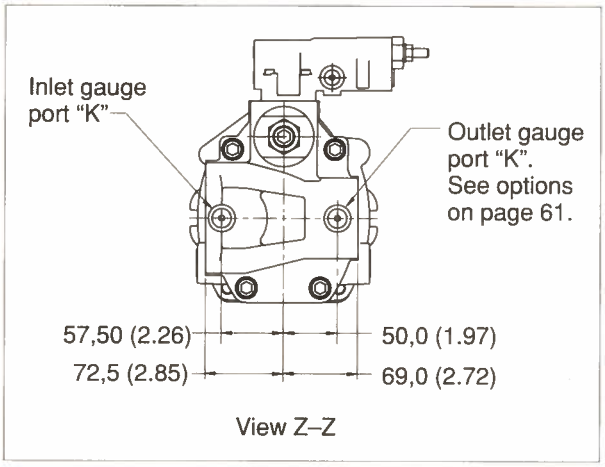
Inlet position for left hand rotation (Position for right hand rotation shown above)

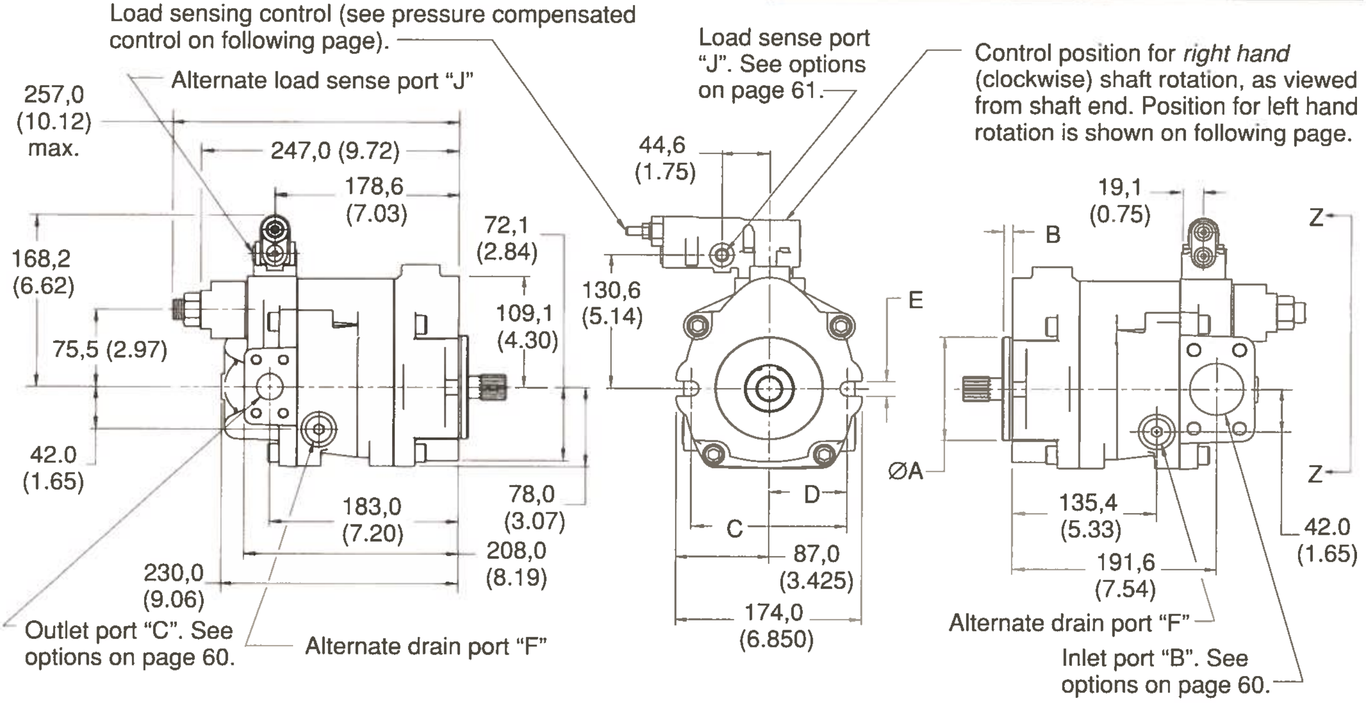
Inlet/Outlet Ports and Control Positioned for *Left Hand Rotation*
Dimensions shown on preceding page.

PVQ50 Side-ported Models

Dimensions in millimeters (inches)

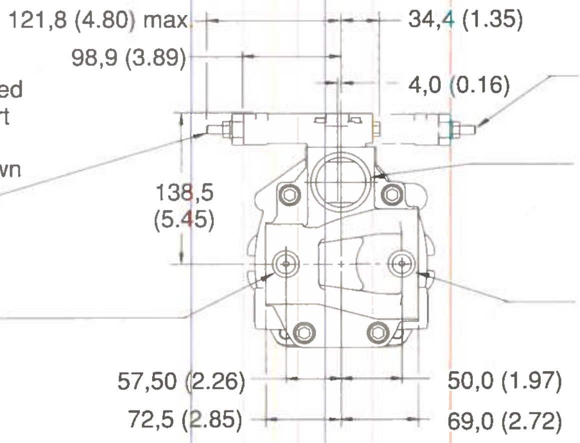

Adjustable max. displacement stop (1 turn = 2 cm³/rev). Turn CCW to reduce displacement.
Drain port "F". See options on page 61.
Start on page 56 for shaft options.
80,0 (3.15)
36,9 (1.45)
160.0 (6.30)
134.3 (5.29) max.
80,0 (3.15)
80,0 (3.15)




Load sensing control (see pressure compensated control on following page).
Alternate load sense port "J"
257,0 (10.12) max.
247,0 (9.72)
178,6 (7.03)
72,1 (2.84)
168,2 (6.62)
109,1 (4.30)
75,5 (2.97)
42.0 (1.65)
183,0 (7.20)
78,0 (3.07)
208,0 (8.19)
230,0 (9.06)
Outlet port "C". See options on page 60.
Alternate drain port "F"
Load sense port "J". See options on page 61.
44,6 (1.75)
130,6 (5.14)
E
ØA
D
C
87,0 (3.425)
174,0 (6.850)
Control position for right hand (clockwise) shaft rotation, as viewed from shaft end. Position for left hand rotation is shown on following page.
19,1 (0.75)
B
Z
Z
135,4 (5.33)
191,6 (7.54)
42.0 (1.65)
Alternate drain port "F"
Inlet port "B". See options on page 60.

Flange Designation	ØA	B	C	D	E
SAE J744-101-2	101,60/101,55 (4.000/3.998)	9,70/9,19 (.382/.362)	146,0 (5.750)	73,0 (2.875)	14,55/14,17 (.572/.557)
ISO 3019/2-100A2HW	100,00/99.95 (3.937/3.935)	9,50/9,00 (.374/.354)	140,0 (5.512)	70,0 (2.756)	14,27/14,00 (.562/.551)

Dimensions in millimeters (inches)



Control position for *left hand rotation* (Pressure compensated control shown). Inlet/outlet port positions for left hand rotation are the opposite of those shown for right hand rotation on preceding page.

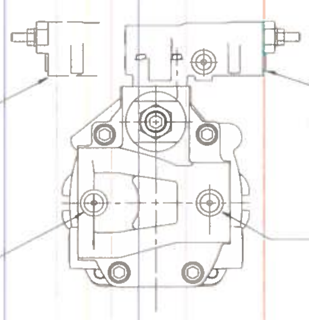
Outlet gauge port “K”. See options on page 61.

Control position for *right hand rotation* (Inlet/outlet port positions for right hand rotation are shown on preceding page.)

Non-maximum adjustment stop control cap. See preceding page for adjustable maximum displacement stop.

Inlet gauge port “K”

Inlet/Outlet Ports and Control Positioned for *Left Hand Rotation*



Control position for *left hand rotation* (Inlet/outlet port positions for left hand rotation are the opposite of those shown for right hand rotation on preceding page.)

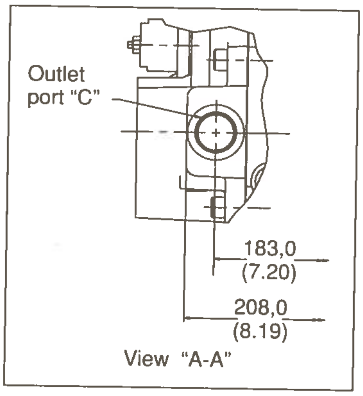
Inlet gauge port “K”

Control position for *right hand rotation* (Load sensing control shown). Inlet/outlet port positions for right hand rotation are shown on preceding page.

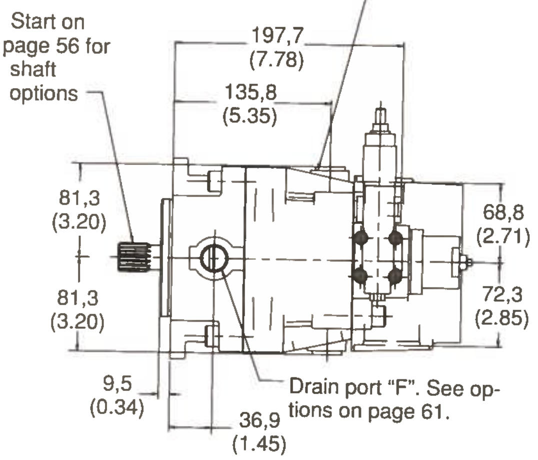
Outlet gauge port “K”. See options on page 61.

Inlet/Outlet Ports and Control Positioned for *Right Hand Rotation*
Dimensions shown on preceding page.

Dimensions in millimeters (inches)



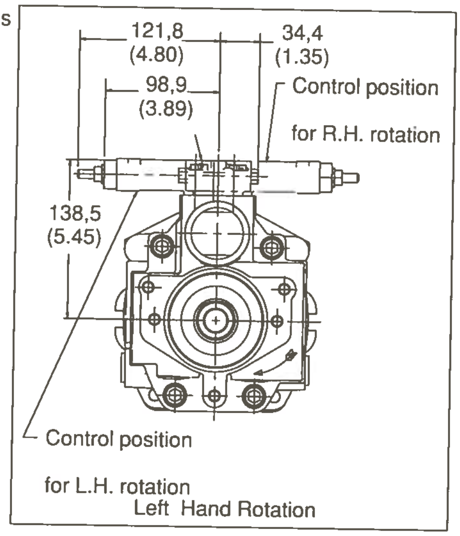
View "A-A"



Start on page 56 for shaft options

Alt. drain port "F". See options on page 61.

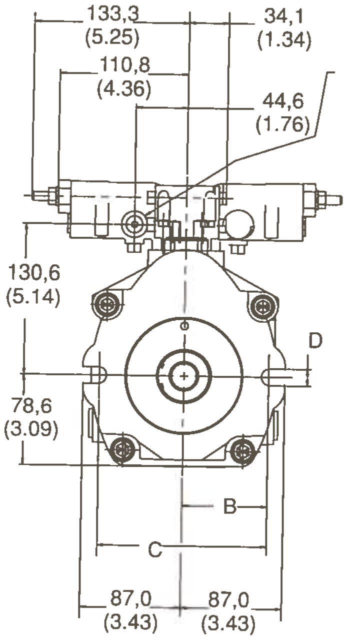
Drain port "F". See options on page 61.



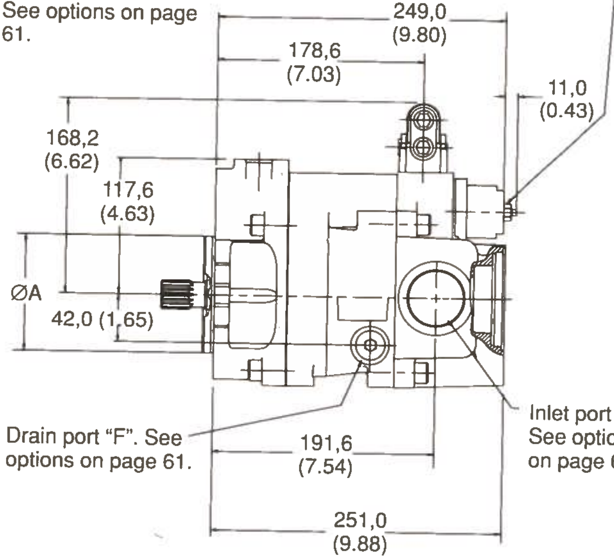
Control position for R.H. rotation

Control position for L.H. rotation

Left Hand Rotation



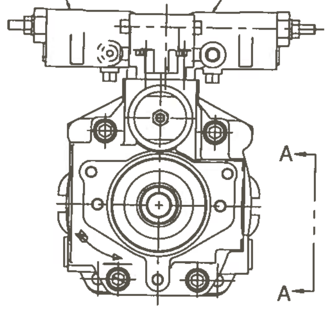
Load sense port "J". See options on page 61.



Adjustable maximum displacement stop (1 turn = 2,1 cm^3/rev). Turn CCW to reduce displacement.

Drain port "F". See options on page 61.

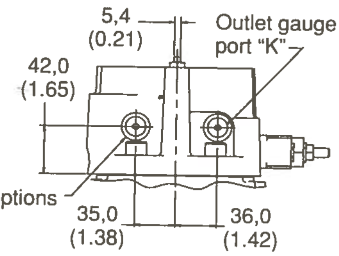
Inlet port "B". See options on page 60.



Load sense control position for L.H. rotation

Load sense control position for R.H. rotation

Right Hand Rotation



Outlet gauge port "K"

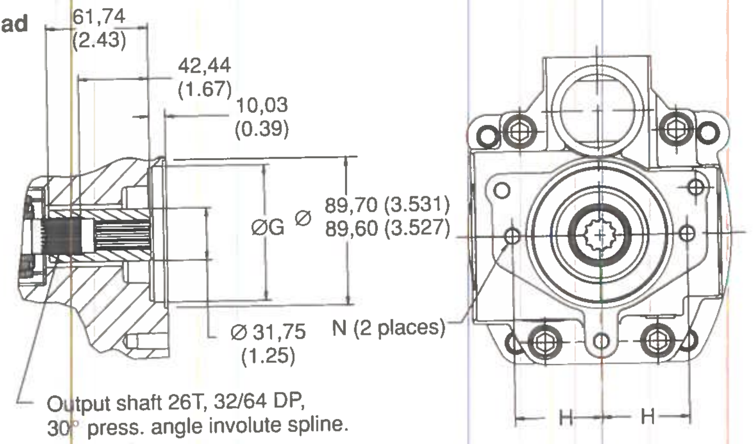
Inlet gauge port "K". See options on page 61.

Flange Designation	ØA	B	C	D
SAE 2-bolt mount	101,60/101,55 (4.000/3.998)	73,0 (2.87)	146,0 (5.750)	14,55/14,17 (.572/.557)
ISO 100 2-bolt mount	100,00/99.95 (3.937/3.935)	70,0 (2.76)	140,0 (5.512)	14,27/14,00 (.562/.551)

PVQ50 Thru-drive Models

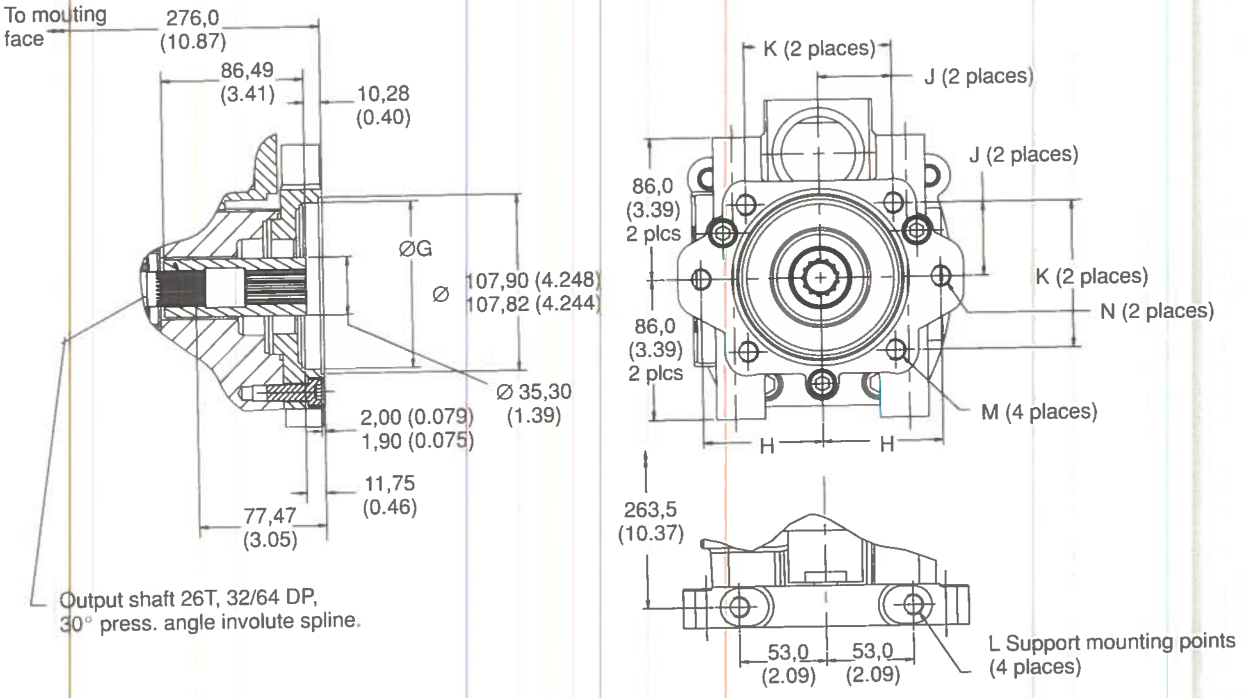
Dimensions in millimeters (inches)

"A" Pad



Coupling Code	Description
A9	For SAE "A" pad with a 9T, 16/32 DP, 30° pressure angle involute spline.
A11	For SAE "A" pad with a 11T, 16/32 DP, 30° pressure angle involute spline.
B13	For SAE "B" pad with a 13T, 16/32 DP, 30° pressure angle involute spline.
B15	For SAE "B" pad with a 15T, 16/32 DP, 30° pressure angle involute spline.
MA9	For ISO 80-A2HW pad with a 9T SAE spline.
MA11	For ISO 80-A2HW pad with a 11T SAE spline.
MB13	For ISO 100-A2/B4HW pad with a 13T SAE spline.

"B" Pad



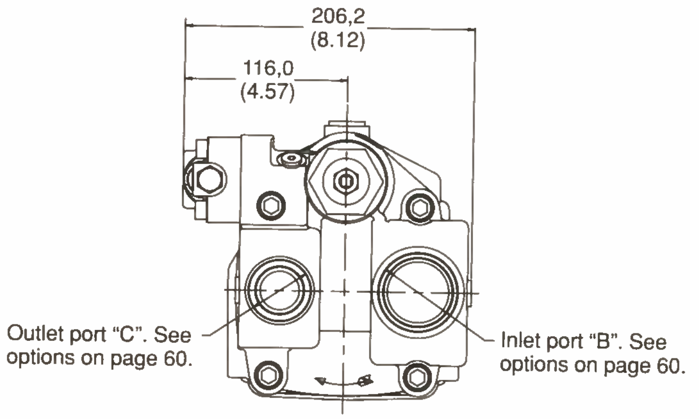
Thru-drive Flange Designation	ØG	H	J	K	L	M	N
SAE "A" Pad	82,625 (3.253) 82,575 (3.250)	53,2 (2.09)	–	–	–	–	.375-16 UNC-2B thd 0.60 deep min
ISO 80-A2HW Pad	80,046 (3.15) 80,002 (3.149)	54,5 (2.15)	–	–	–	–	M10 thd x 15,0 deep min
SAE "B" Pad	101,65 (4.002) 101,60 (4.00)	73,0 (2.87)	44,9 (1.77)	89,8 (3.54)	.500-13 UNC-2B thd 1.00" deep min M12 x 24,9 deep min	.500-13 UNC-2B thd thru M10 thd thru	.500-13 UNC-2B thd thru M12 thd thru
ISO 100-A2/B4HW Pad	100,0 (3.937) 99,946 (3.935)	70,0 (2.76)	44,2 (1.74)	88,38 (3.48)	M12 thd x 24,9 deep min	M10 thd thru	M12 thd thru

PVQ63 End-ported Models

Dimensions in millimeters (inches)

See mounting flange options on page 55.

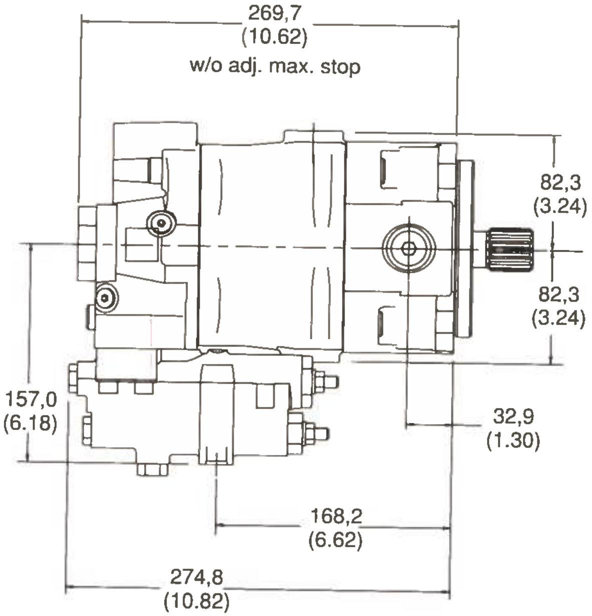
Start on page 56 for shaft options.

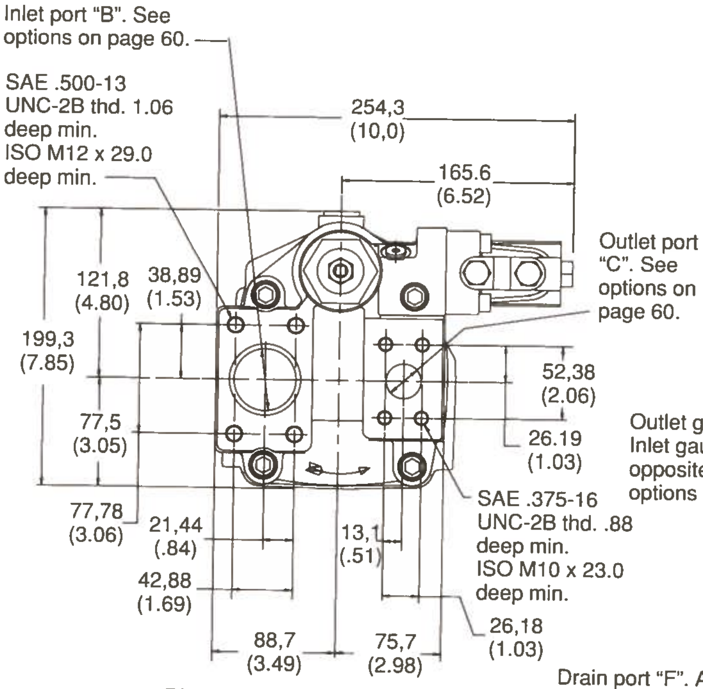


Outlet port "C". See options on page 60.

Inlet port "B". See options on page 60.

Left Hand Rotation, Tube Port with "C" Compensator





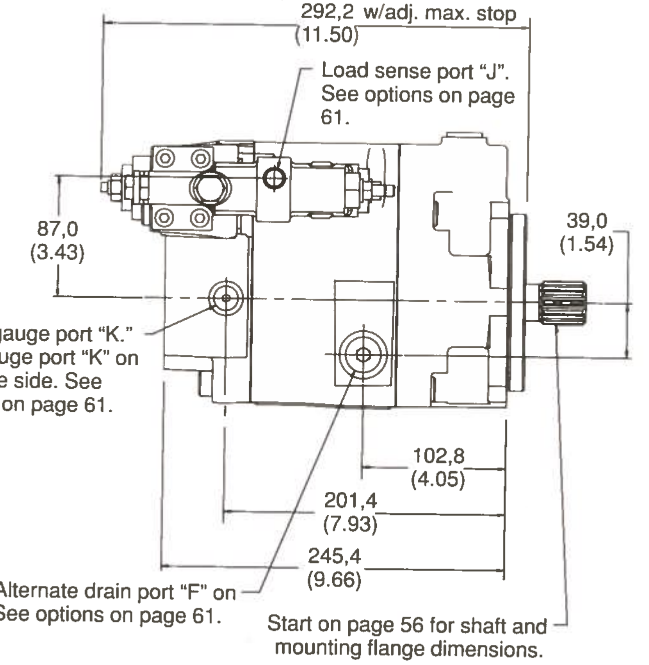
Inlet port "B". See options on page 60.

SAE .500-13 UNC-2B thd. 1.06 deep min.
ISO M12 x 29.0 deep min.

Outlet port "C". See options on page 60.

SAE .375-16 UNC-2B thd. .88 deep min.
ISO M10 x 23.0 deep min.

Right Hand Rotation, Flange Port with "CV" Compensator



Load sense port "J". See options on page 61.

Outlet gauge port "K." Inlet gauge port "K" on opposite side. See options on page 61.

Drain port "F". Alternate drain port "F" on opposite side. See options on page 61.

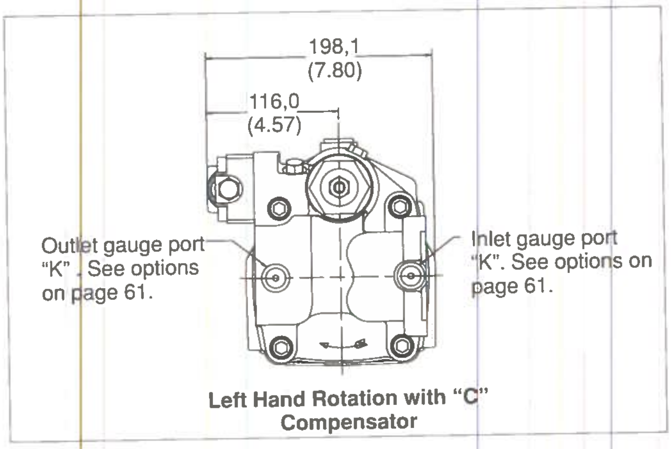
Start on page 56 for shaft and mounting flange dimensions.

PVQ63 Side-ported Models

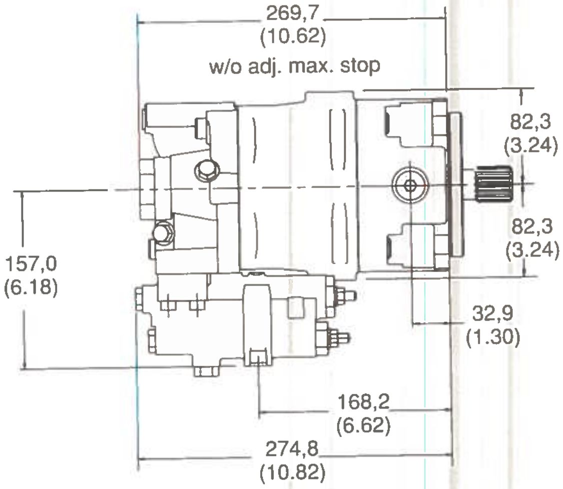
Dimensions in millimeters (inches)

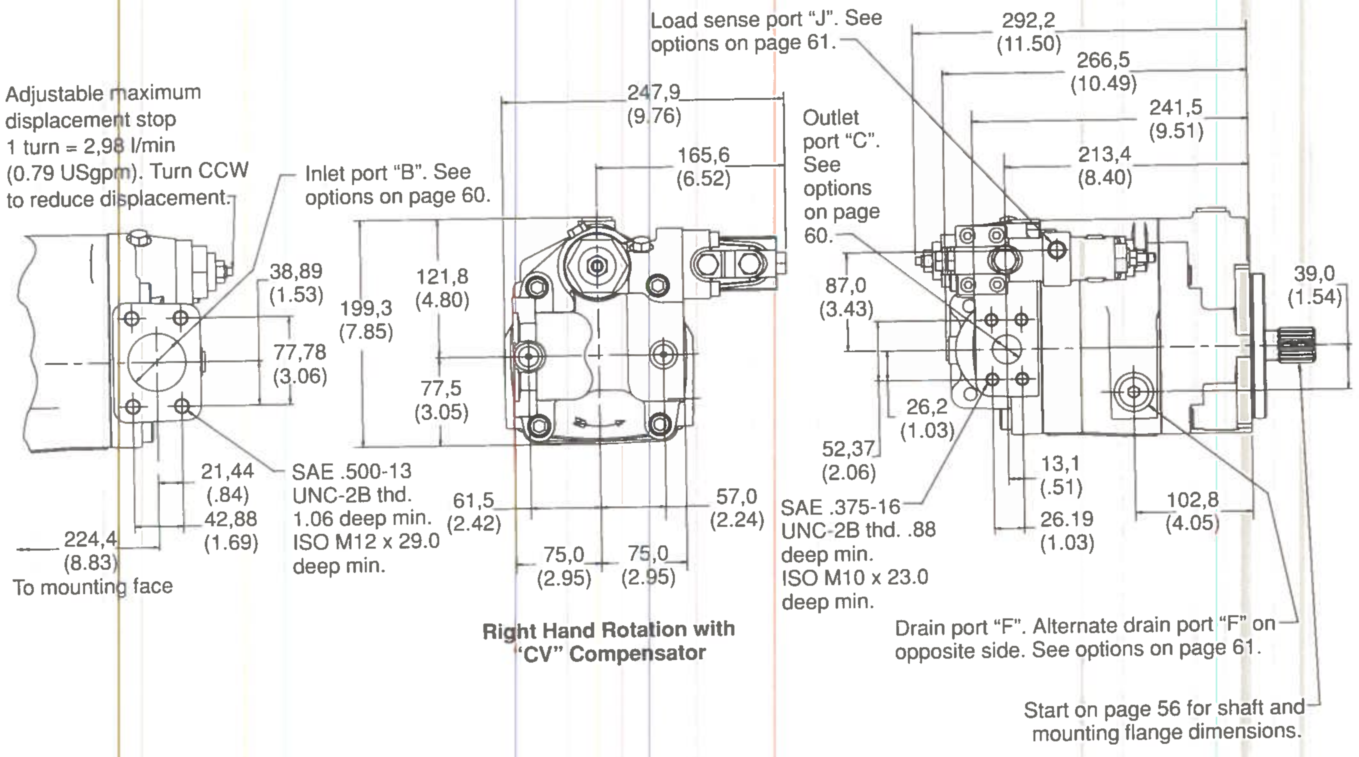
See mounting flange options on page 55.

Start on page 56 for shaft options.


198,1
(7.80)
116,0
(4.57)
Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.

Left Hand Rotation with "C" Compensator




Adjustable maximum displacement stop 1 turn = 2,98 l/min (0.79 USgpm). Turn CCW to reduce displacement.
Inlet port "B". See options on page 60.
38,89
(1.53)
77,78
(3.06)
21,44
(.84)
42,88
(1.69)
224,4
(8.83)
To mounting face
SAE .500-13 UNC-2B thd. 1.06 deep min. ISO M12 x 29.0 deep min.
247,9
(9.76)
165,6
(6.52)
121,8
(4.80)
199,3
(7.85)
77,5
(3.05)
61,5
(2.42)
57,0
(2.24)
75,0
(2.95)
75,0
(2.95)
Load sense port "J". See options on page 61.
Outlet port "C". See options on page 60.
292,2
(11.50)
266,5
(10.49)
241,5
(9.51)
213,4
(8.40)
87,0
(3.43)
39,0
(1.54)
26,2
(1.03)
52,37
(2.06)
13,1
(.51)
26.19
(1.03)
102,8
(4.05)
SAE .375-16 UNC-2B thd. .88 deep min. ISO M10 x 23.0 deep min.
Drain port "F". Alternate drain port "F" on opposite side. See options on page 61.
Start on page 56 for shaft and mounting flange dimensions.

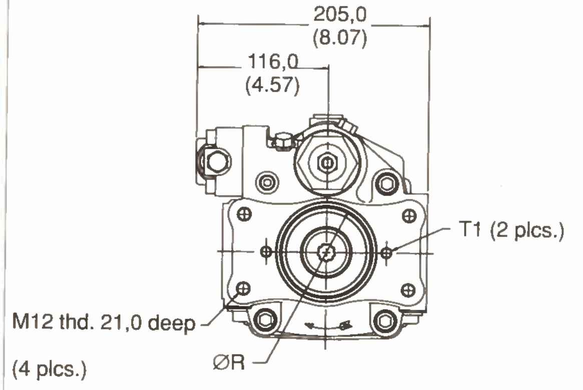
Right Hand Rotation with "CV" Compensator

PVQ63 Thru-drive Models

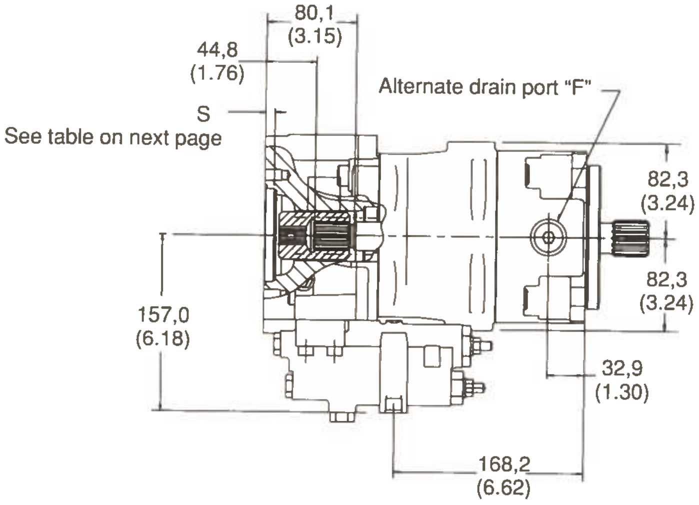
Dimensions in millimeters (inches)

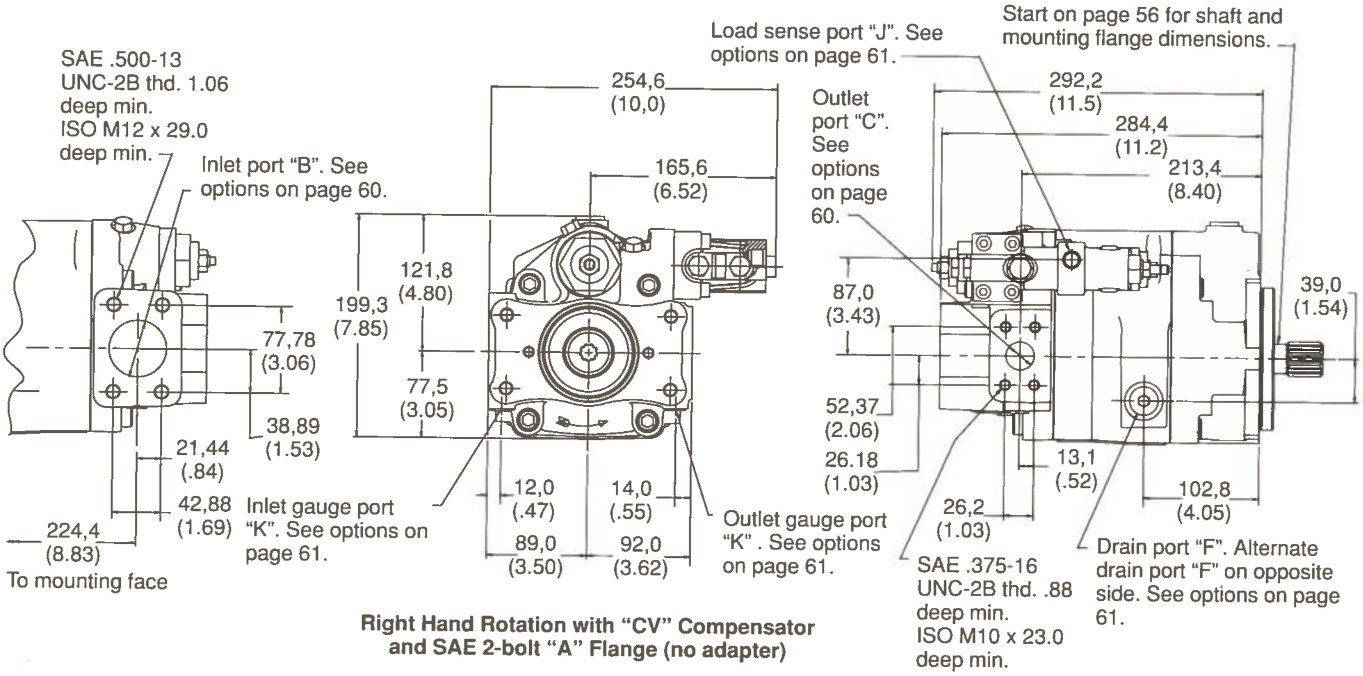
See mounting flange options on page 55.

Start on page 56 for shaft options.



Left Hand Rotation with "C" Compensator and SAE 2-bolt "A" Flange (no adapter)

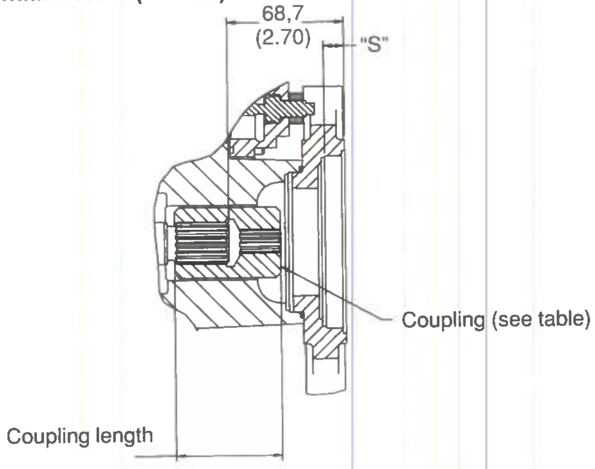




Right Hand Rotation with "CV" Compensator and SAE 2-bolt "A" Flange (no adapter)

PVQ63 Thru-drive Models

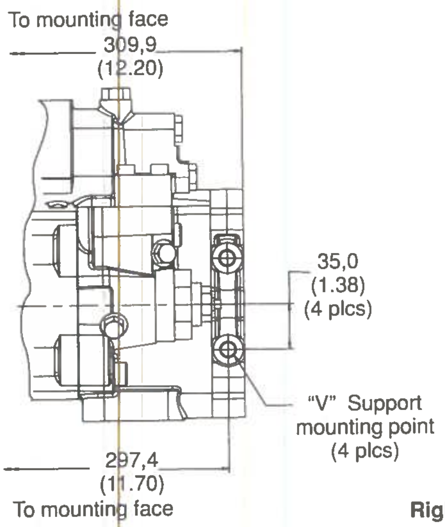
Dimensions in millimeters (inches)

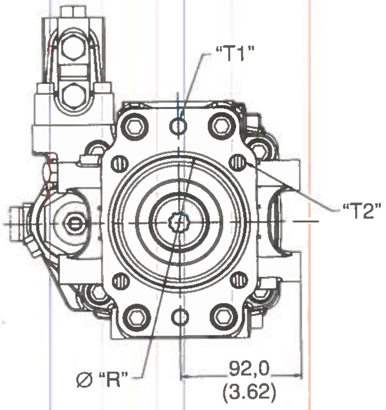


Coupling length	
SAE "A", 9T	62,5 (2.46)
SAE "B", 13T	93,0 (3.66)
SAE "B-B", 15T	93,0 (3.66)
SAE "C", 14T	93,0 (3.66)

Coupling Code	Description
A9	SAE "A", 9T, 16/32 DP, 30° pressure angle involute spline.
B13	SAE "B", 13T, 16/32 DP, 30° pressure angle involute spline.
B15	SAE "B-B", 15T, 16/32 DP, 30° pressure angle involute spline.
C14	SAE "C", 14T, 12/24 DP, 30° pressure angle involute spline.
MA9	For ISO 80-A2HW pad with a 9T SAE spline.
MA11	For ISO 80-A2HW pad with a 11T SAE spline.
MB13	For ISO 100-A2/B4HW pad with a 13T SAE spline.
MB15	For ISO 100-A2/B4HW pad with a 15T SAE spline.
MC14	For ISO 125-A2/B4HW pad with a 14T SAE spline.
MC17	For ISO 125-A2/B4HW pad with a 17T SAE spline.

"B" Adapter Flange



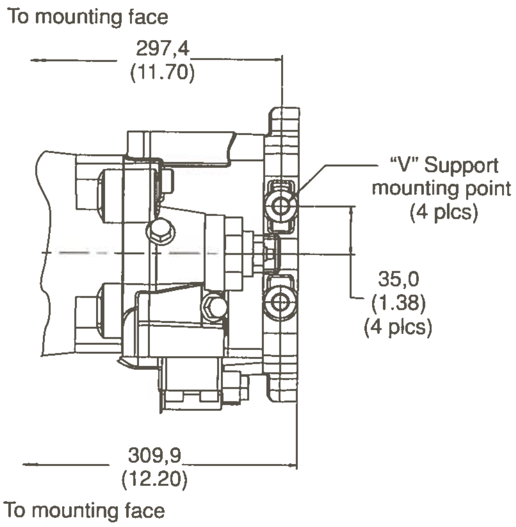


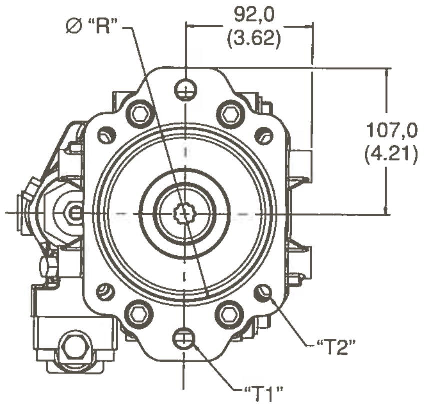
Right hand rotation with "CV" compensator and SAE 2/4 bolt "B" adapter flange

Adapter	Flange	Bolt	Pilot Dia. "R"	Pilot Depth "S"	2-bolt "T1"	4-bolt "T2"	Support Mounting Point "V"
None	SAE "A" 2-bolt	SAE	Ø82,6 (3.25)	9,0/8,0 (.35/.31)	.375-16 UNC-2B thd	N/A	N/A
		ISO			M10 thd.	N/A	N/A
	ISO 80	ISO	Ø80,05 (3.15)	9,0/8,0 (.35/.31)	M10 thd.	N/A	N/A
B	SAE "B" 2/4 bolt	SAE	Ø101,65 (4.00)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep
		ISO			M12 thd.	M12 thd.	M12 thd x 25,0 deep
	ISO 100	ISO	Ø100,05 (3.94)	12,5/11,5 (.49/.45)	M12 thd.	M12 thd.	M12 thd x 25,0 deep

Dimensions in millimeters (inches)

"C" Adapter Flange



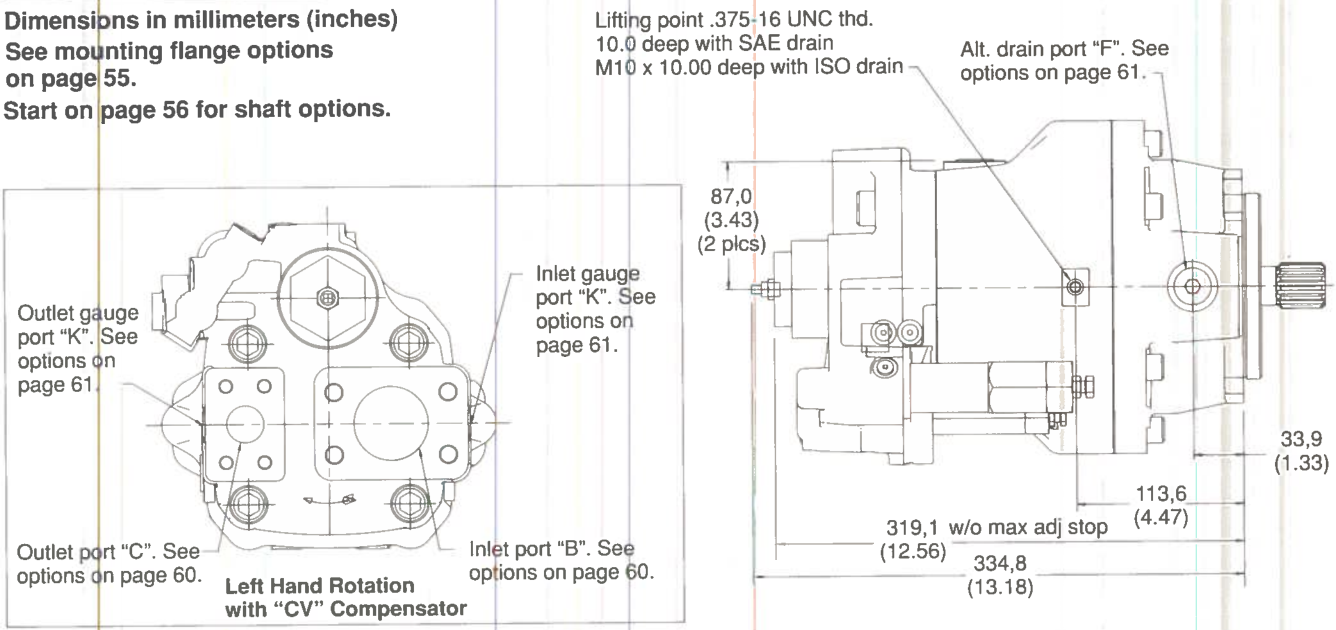


Left hand rotation with "C" compensator and SAE 2/4 bolt "C" adapter flange

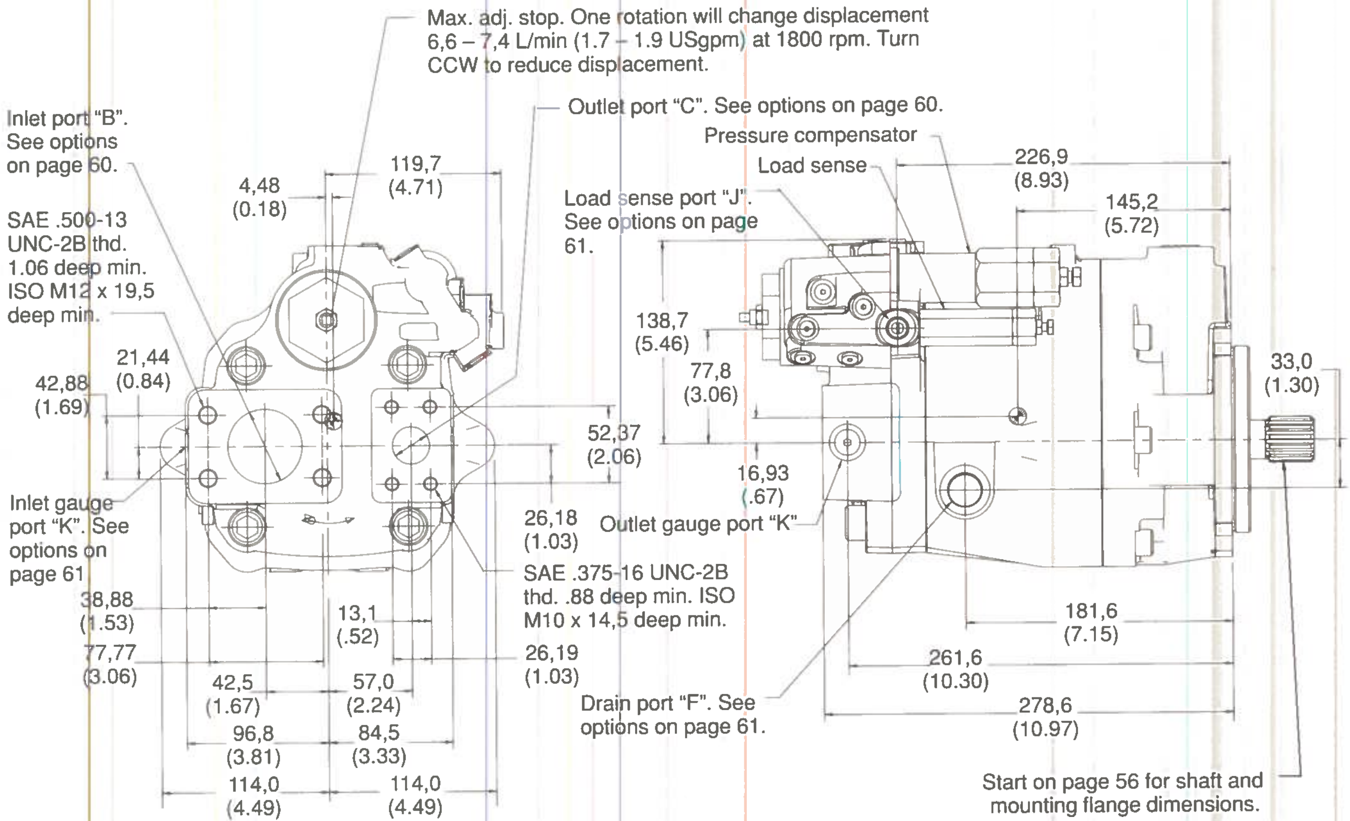
Adapter	Flange	Bolt	Pilot Dia. "R"	Pilot Depth "S"	2-bolt "T1"	4-bolt "T2"	Support Mouting Point "V"
C	SAE "C" 2/4 bolt	SAE	Ø127,05 (5.00)	15,5/14,5 (.61/.57)	.625-11 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep
		ISO			M16 thd.	M12 thd.	M12 thd x 25,0 deep
	ISO 125	ISO	Ø125,05 (4.92)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd x 25,0 deep

PVQ81 End-ported Models

Dimensions in millimeters (inches)
See mounting flange options on page 55.
Start on page 56 for shaft options.


Lifting point .375-16 UNC thd. 10.0 deep with SAE drain M10 x 10.00 deep with ISO drain
Alt. drain port "F". See options on page 61.
87,0 (3.43) (2 plcs)
33,9 (1.33)
113,6 (4.47)
319,1 w/o max adj stop (12.56)
334,8 (13.18)
Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.
Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.

Left Hand Rotation with "CV" Compensator


Max. adj. stop. One rotation will change displacement 6,6 – 7,4 L/min (1.7 – 1.9 USgpm) at 1800 rpm. Turn CCW to reduce displacement.
Outlet port "C". See options on page 60.
Pressure compensator
Load sense
Load sense port "J". See options on page 61.
Inlet port "B". See options on page 60.
SAE .500-13 UNC-2B thd. 1.06 deep min. ISO M12 x 19,5 deep min.
4,48 (0.18)
119,7 (4.71)
21,44 (0.84)
42,88 (1.69)
Inlet gauge port "K". See options on page 61
38,88 (1.53)
77,77 (3.06)
13,1 (.52)
42,5 (1.67)
57,0 (2.24)
96,8 (3.81)
84,5 (3.33)
114,0 (4.49)
114,0 (4.49)
52,37 (2.06)
26,18 (1.03)
26,19 (1.03)
SAE .375-16 UNC-2B thd. .88 deep min. ISO M10 x 14,5 deep min.
226,9 (8.93)
145,2 (5.72)
138,7 (5.46)
77,8 (3.06)
16,93 (.67)
Outlet gauge port "K"
33,0 (1.30)
181,6 (7.15)
261,6 (10.30)
278,6 (10.97)
Drain port "F". See options on page 61.
Start on page 56 for shaft and mounting flange dimensions.

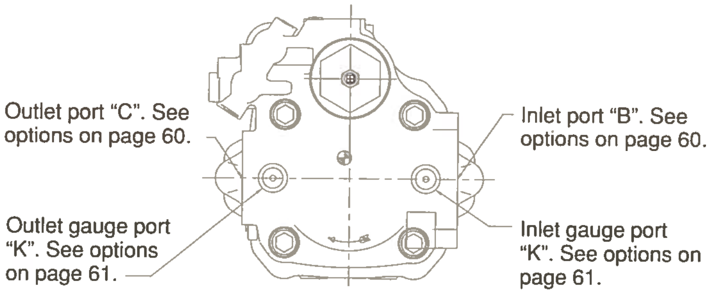
Right Hand Rotation with "CV" Compensator

PVQ81 Side-ported Models

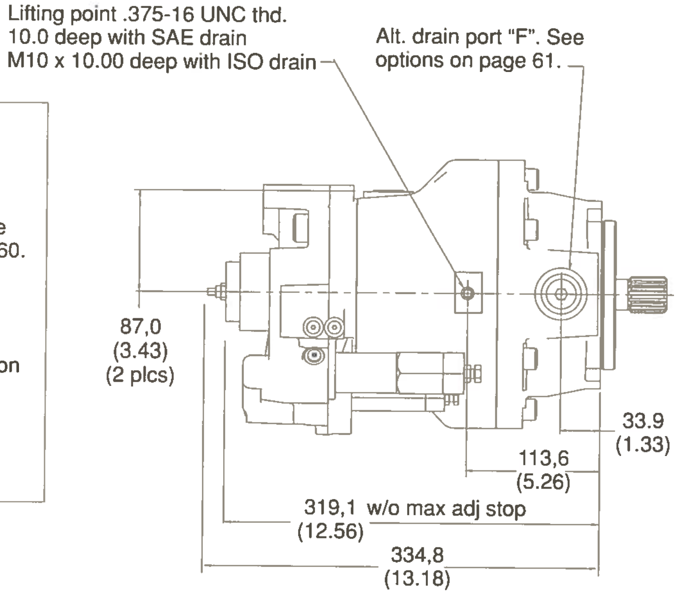
Dimensions in millimeters (inches)

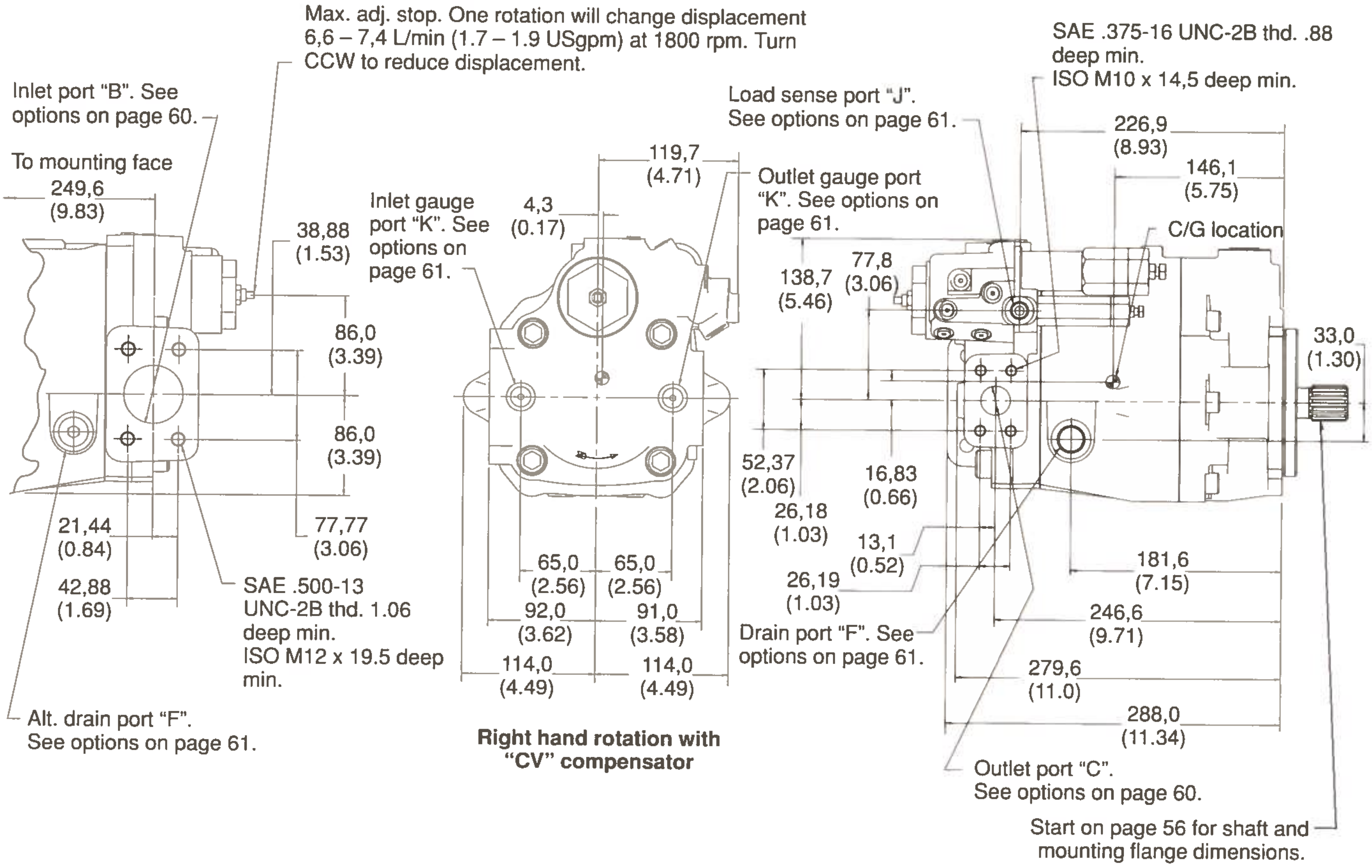
See mounting flange options on page 55.

Start on page 56 for shaft options.


Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.
Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.

Left hand rotation
("C" compensator is the same envelope size as the "CV" compensator.)


Lifting point .375-16 UNC thd. 10.0 deep with SAE drain M10 x 10.00 deep with ISO drain
Alt. drain port "F". See options on page 61.
87,0 (3.43) (2 plcs)
33.9 (1.33)
113,6 (5.26)
319,1 w/o max adj stop (12.56)
334,8 (13.18)


Max. adj. stop. One rotation will change displacement 6,6 – 7,4 L/min (1.7 – 1.9 USgpm) at 1800 rpm. Turn CCW to reduce displacement.
Inlet port "B". See options on page 60.
To mounting face
249,6 (9.83)
38,88 (1.53)
86,0 (3.39)
86,0 (3.39)
77,77 (3.06)
21,44 (0.84)
42,88 (1.69)
SAE .500-13 UNC-2B thd. 1.06 deep min. ISO M12 x 19.5 deep min.
Alt. drain port "F". See options on page 61.
Inlet gauge port "K". See options on page 61.
4,3 (0.17)
119,7 (4.71)
Outlet gauge port "K". See options on page 61.
65,0 (2.56)
65,0 (2.56)
92,0 (3.62)
91,0 (3.58)
114,0 (4.49)
114,0 (4.49)
Load sense port "J". See options on page 61.
SAE .375-16 UNC-2B thd. .88 deep min. ISO M10 x 14,5 deep min.
226,9 (8.93)
146,1 (5.75)
C/G location
138,7 (5.46)
77,8 (3.06)
33,0 (1.30)
52,37 (2.06)
16,83 (0.66)
26,18 (1.03)
13,1 (0.52)
26,19 (1.03)
Drain port "F". See options on page 61.
181,6 (7.15)
246,6 (9.71)
279,6 (11.0)
288,0 (11.34)
Outlet port "C". See options on page 60.
Start on page 56 for shaft and mounting flange dimensions.

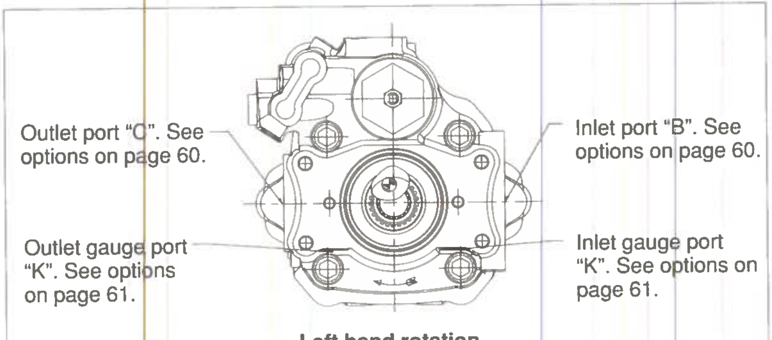
Right hand rotation with "CV" compensator

PVQ81 Thru-drive Models

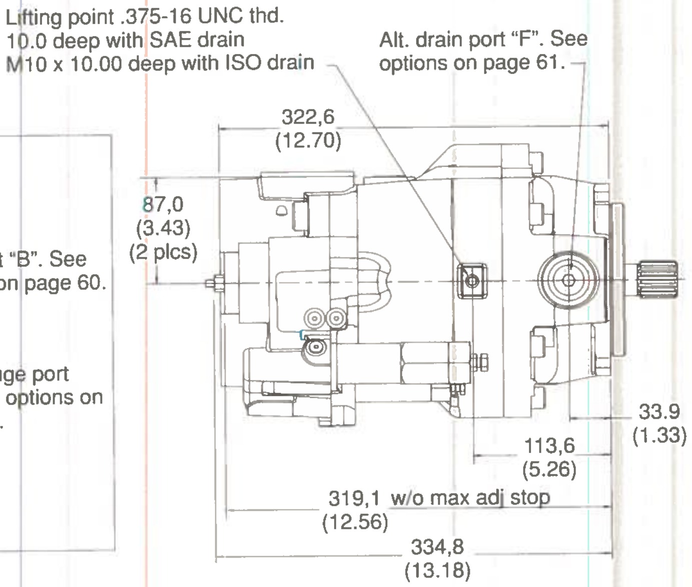
Dimensions in millimeters (inches)

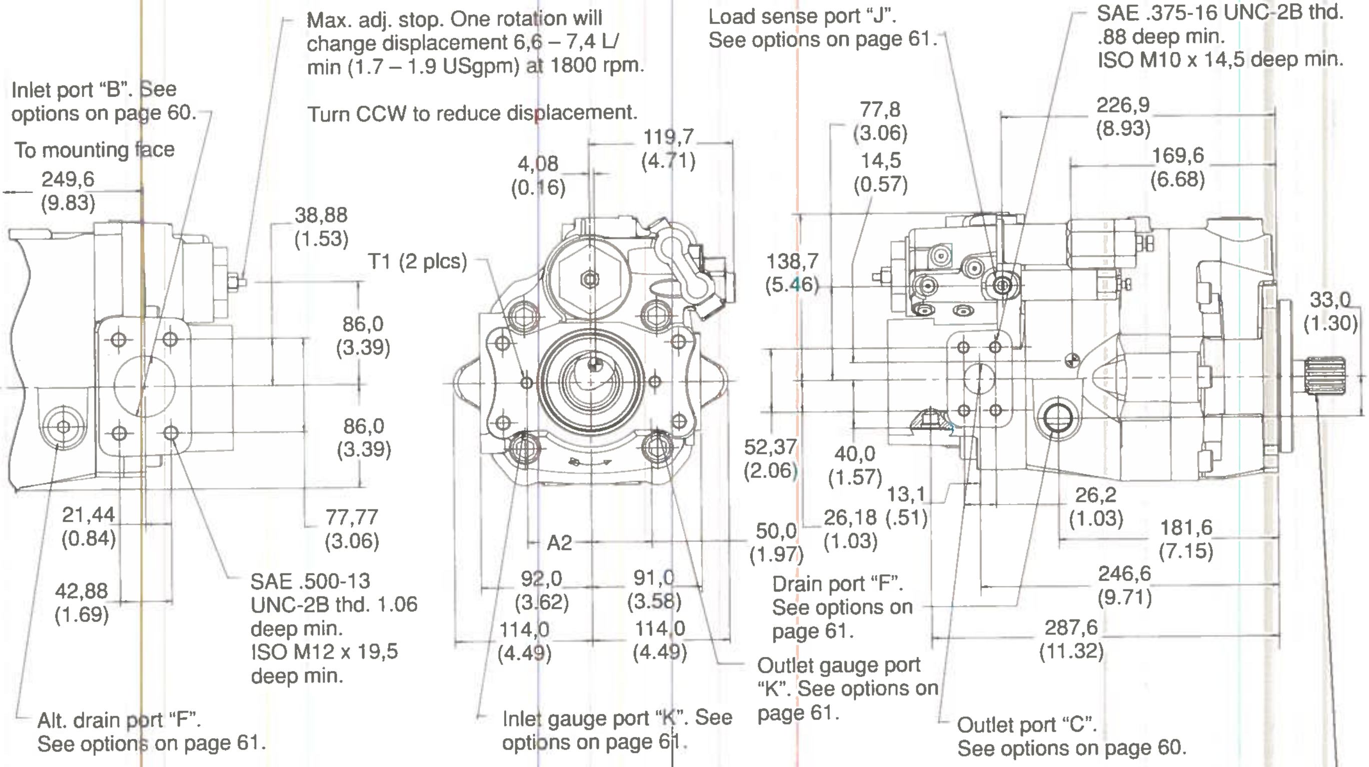
See mounting flange options on page 55.

Start on page 56 for shaft options.


Outlet port "C". See options on page 60.
Outlet gauge port "K". See options on page 61.
Inlet port "B". See options on page 60.
Inlet gauge port "K". See options on page 61.

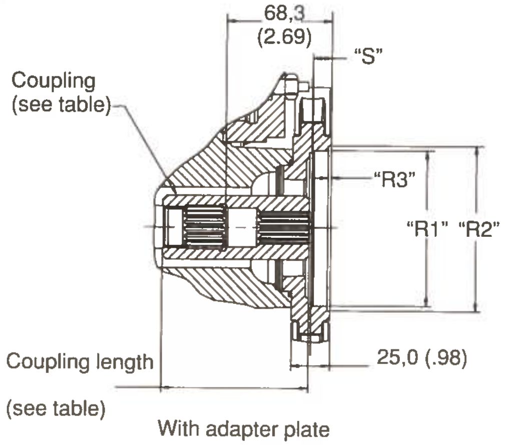
Left hand rotation
("C" compensator is the same envelope size as the "CV" compensator.)



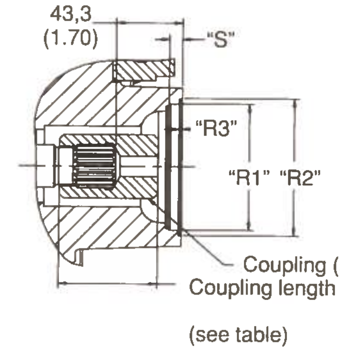


Right hand rotation with "CV" compensator

Dimensions in millimeters (inches)



With adapter plate

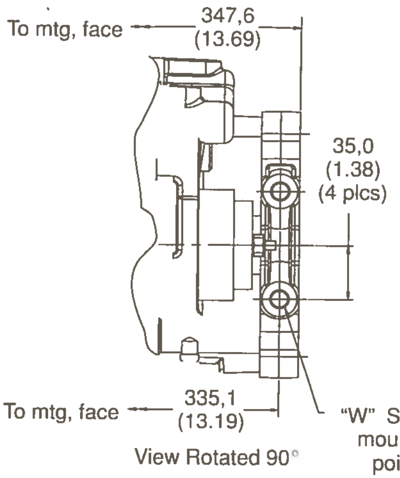


Without adapter plate

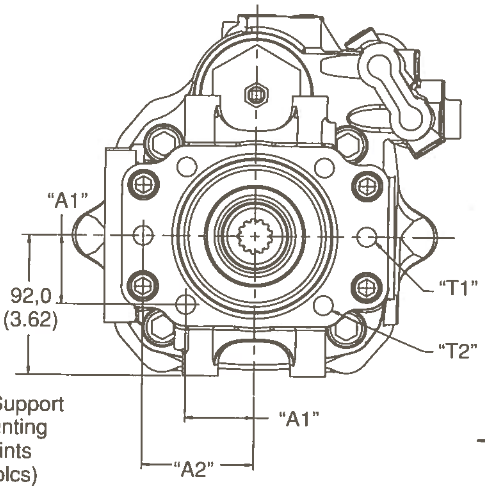
Coupling length	
SAE "A", 9T	64,5 (2.54)
SAE "A", 11T	65,3 (2.57)
SAE "B", 13T	95,3 (3.75)
SAE "B-B", 15T	95,3 (3.75)
SAE "C", 14T	95,3 (3.75)
SAE "C-C", 17T	91,8 (3.61)

Coupling Code	Description
A9	SAE "A", 9T, 16/32 DP, 30° pressure angle involute spline.
A11	SAE "A", 11T, 16/32 DP, 30° pressure angle involute spline.
B13	SAE "B", 13T, 16/32 DP, 30° pressure angle involute spline.
B15	SAE "B-B", 15T, 16/32 DP, 30° pressure angle involute spline.
C14	SAE "C", 14T, 12/24 DP, 30° pressure angle involute spline.
C17	SAE "C-C", 17T, 12/24 DP, 30° pressure angle involute spline.
MA9	For ISO 80-A2HW pad with a 9T SAE spline.
MA11	For ISO 80-A2HW pad with a 11T SAE spline.
MB13	For ISO 100-A2/B4HW pad with a 13T SAE spline.
MB15	For ISO 100-A2/B4HW pad with a 15T SAE spline.
MC14	For ISO 125-A2/B4HW pad with a 14T SAE spline.
MC17	For ISO 125-A2/B4HW pad with a 17T SAE spline.

"B" Adapter Flange



View Rotated 90°

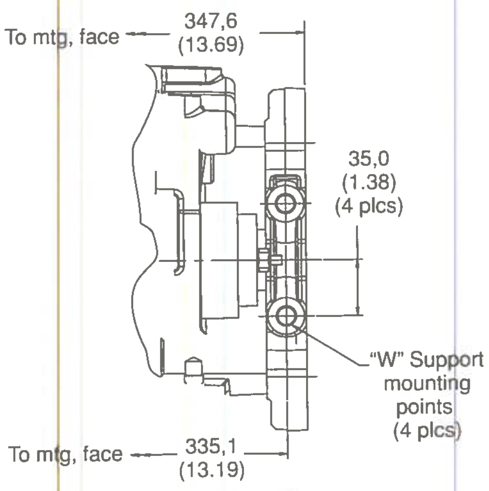


Right hand rotation with "CV" compensation and ISO or SAE 2/4 bolt "B" adapter flange

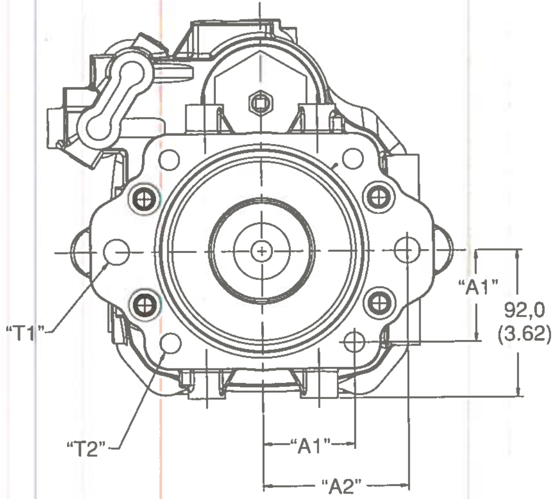
Adapter	Flange	Bolt	Pilot Dia.	O-ring Dia.	O-ring Depth	Pilot Depth	2-bolt	4-bolt	Support Mtg. Point	4-bolt	2-bolt
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
None	SAE "A" 2-bolt	SAE	Ø82,6 (3.25)	Ø89,65 (3.53)	2,00 (.08) 1,90 (.07)	9,0/8,0 (.35/.31)	.375-16 UNC-2B thd	N/A	N/A	N/A	53,2 (2.09)
		ISO					M10 thd.	N/A	N/A	N/A	
	ISO 80	ISO	Ø80,05 (3.15)	Ø89,75 (3.53)	2,70 (.11) 2,60 (.10)	9,0/8,0 (.35/.31)	M10 thd.	N/A	N/A	N/A	54,5 (2.15)
B	SAE "B" 2/4 bolt	SAE	Ø101,65 (4.00)	Ø108,05 (4.25)	2,00 (.08) 1,90 (.07)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep	44,9 (1.77)	73,0 (2.87)
		ISO					M12 thd.	M12 thd.	M12 thd x 25,0 deep		
	ISO 100	ISO	Ø100,05 (3.94)	Ø108,75 (4.28)	2,70 (.11) 2,60 (.10)	12,5/11,5 (.49/.45)	M12 thd.	M10 thd.	M12 thd x 25,0 deep	44,19 (1.74)	70,0 (2.76)

Dimensions in millimeters (inches)

"C" Adapter Flange



View Rotated 90°



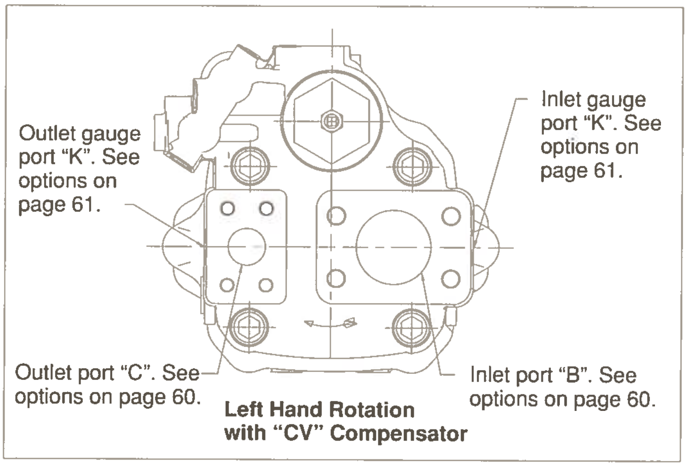
Left hand rotation with "CV" compensator and ISO or SAE 2/4 bolt "C" adapter flange

Adapter	Flange	Bolt	Pilot Dia.	O-ring Dia.	O-ring Depth	Pilot Depth	2-bolt	4-bolt	Support Mtg. Point	4-bolt	2-bolt
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
C	SAE "C" 2/4 bolt	SAE	Ø127,05 (5.00)	Ø133,45 (5.25)	2,00 (.08) 1,90 (.07)	15,5/14,5 (.61/.57)	.625-11 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep	57,25 (2.25)	90,5 (3.56)
		ISO					M16 thd.	M12 thd.	M12 thd. 25,0 deep		
	ISO 125	ISO	Ø125,05 (4.92)	Ø133,75 (3.26)	2,70 (.11) 2,60 (.10)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd. 25,0 deep	56,57 (2.23)	90,0 (3.54)

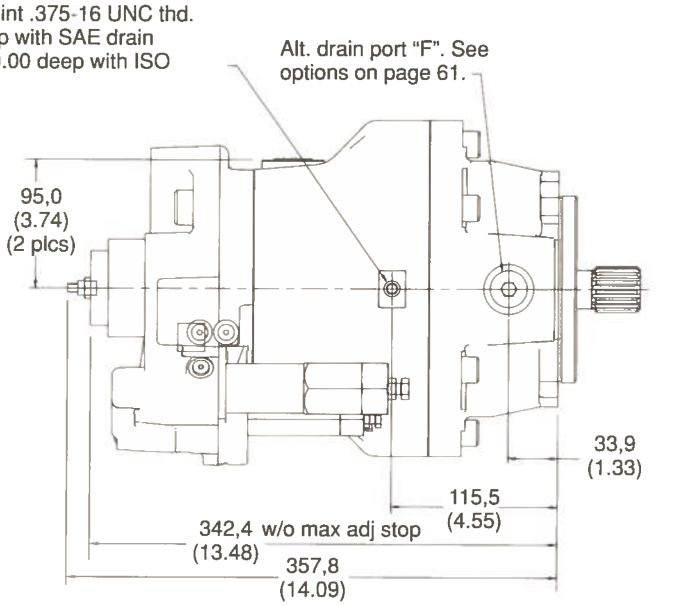
Dimensions in millimeters (inches)

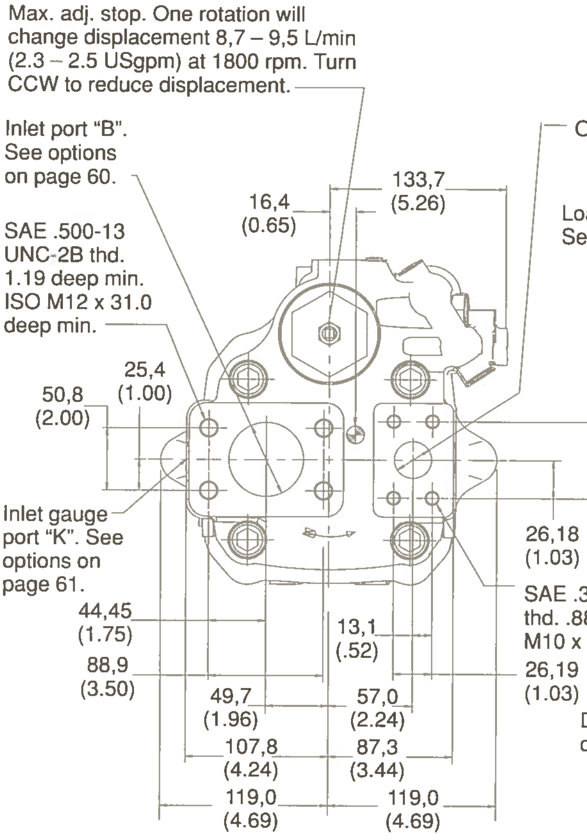
See mounting flange options on page 55.

Start on page 56 for shaft options.

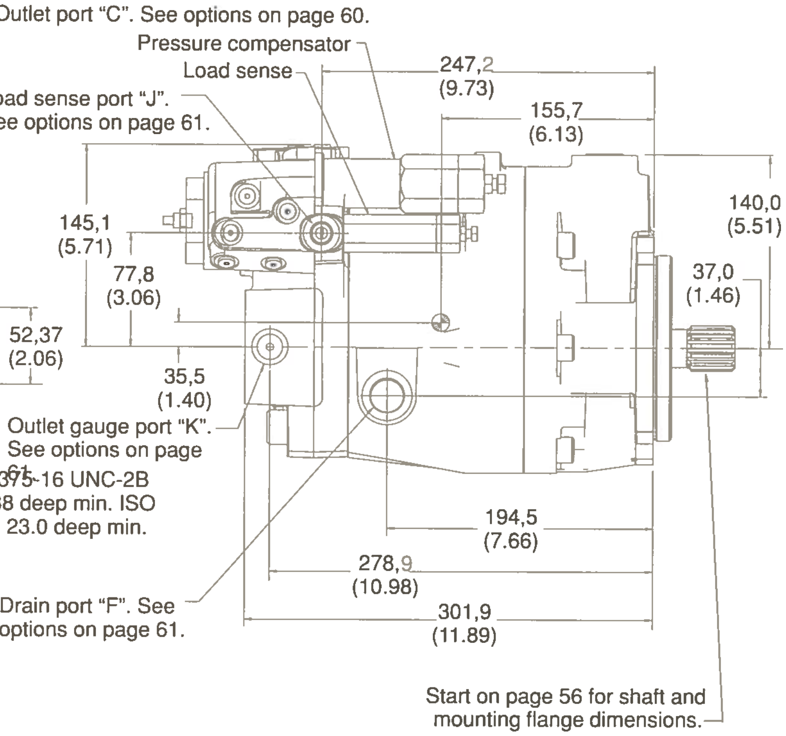

Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.
Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.

Left Hand Rotation with "CV" Compensator


Lifting point .375-16 UNC thd. 10.0 deep with SAE drain M10 x 10.00 deep with ISO drain
Alt. drain port "F". See options on page 61.
95,0
(3.74)
(2 plcs)
33,9
(1.33)
115,5
(4.55)
342,4 w/o max adj stop
(13.48)
357,8
(14.09)


Max. adj. stop. One rotation will change displacement 8,7 – 9,5 L/min (2.3 – 2.5 USgpm) at 1800 rpm. Turn CCW to reduce displacement.
Inlet port "B". See options on page 60.
SAE .500-13 UNC-2B thd. 1.19 deep min. ISO M12 x 31.0 deep min.
16,4
(0.65)
133,7
(5.26)
25,4
(1.00)
50,8
(2.00)
Inlet gauge port "K". See options on page 61.
44,45
(1.75)
88,9
(3.50)
13,1
(.52)
49,7
(1.96)
57,0
(2.24)
107,8
(4.24)
87,3
(3.44)
119,0
(4.69)
119,0
(4.69)
52,37
(2.06)
26,18
(1.03)
SAE .375-16 UNC-2B thd. .88 deep min. ISO M10 x 23.0 deep min.
26,19
(1.03)

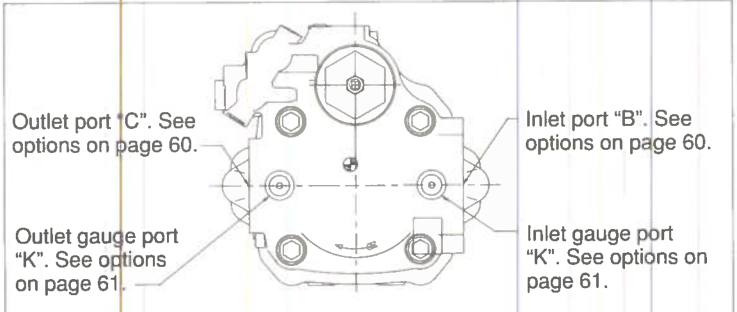
Right Hand Rotation with "CV" Compensator


Outlet port "C". See options on page 60.
Pressure compensator
Load sense
Load sense port "J". See options on page 61.
247,2
(9.73)
155,7
(6.13)
140,0
(5.51)
145,1
(5.71)
77,8
(3.06)
37,0
(1.46)
35,5
(1.40)
Outlet gauge port "K". See options on page 61.
194,5
(7.66)
278,9
(10.98)
301,9
(11.89)
Drain port "F". See options on page 61.
Start on page 56 for shaft and mounting flange dimensions.

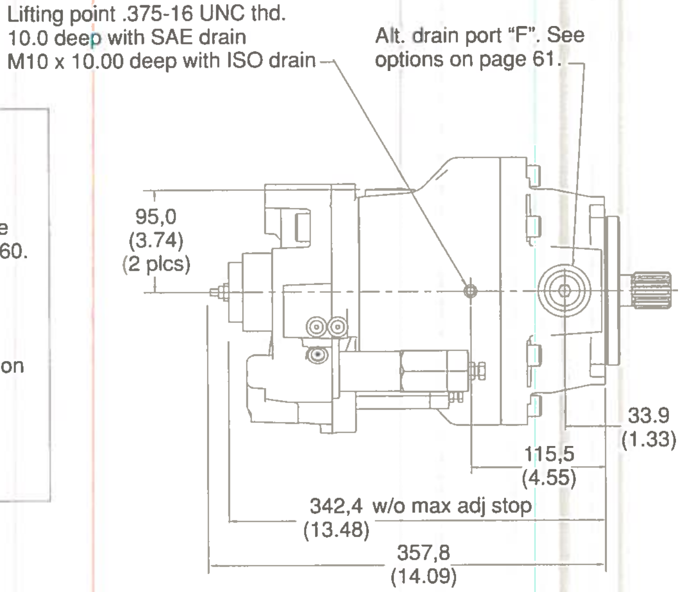
Dimensions in millimeters (inches)

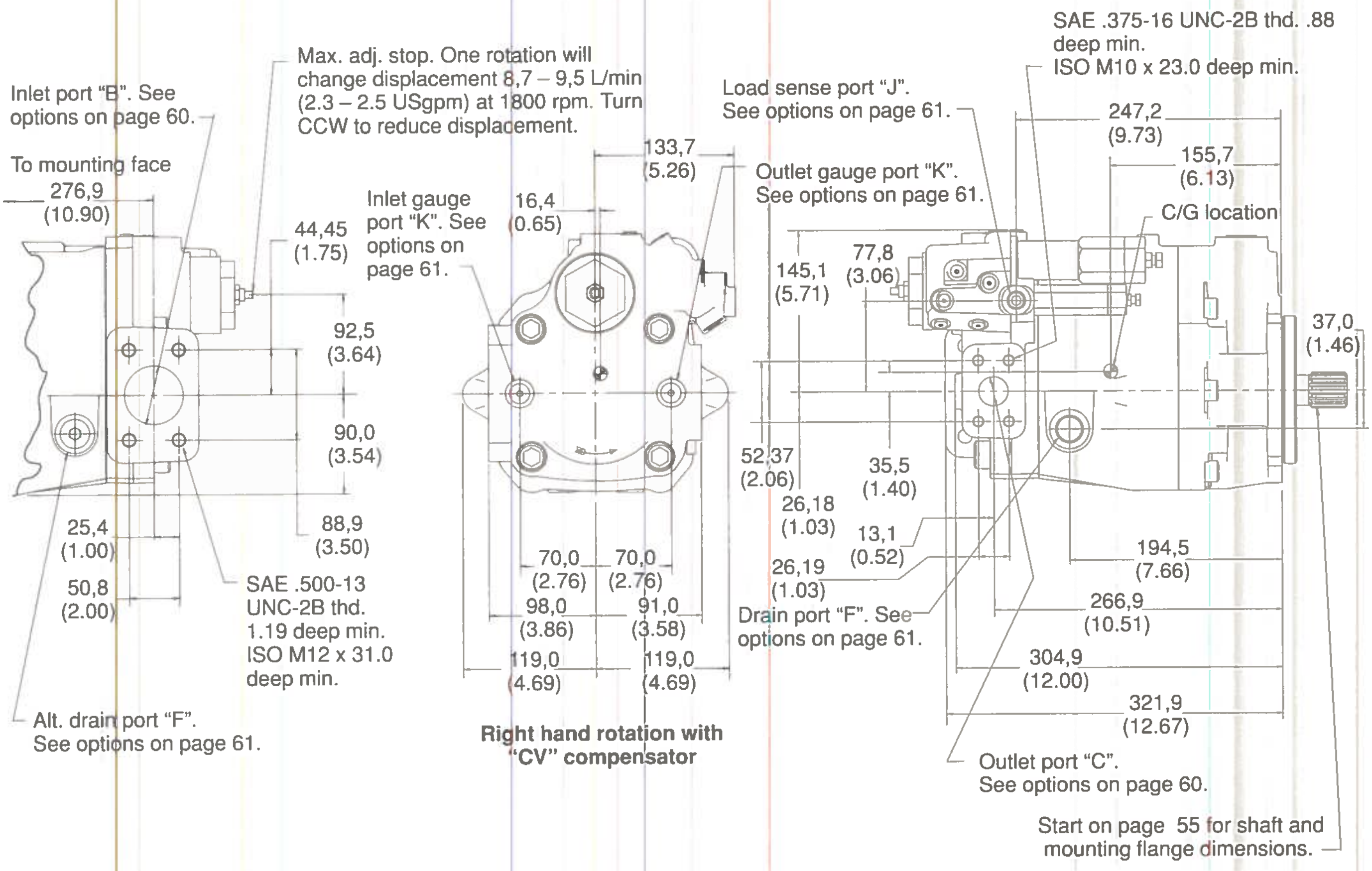
See mounting flange options on page 55.

Start on page 56 for shaft options.


Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.
Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.

Left hand rotation
("C" compensator is the same envelope size as the "CV" compensator.)

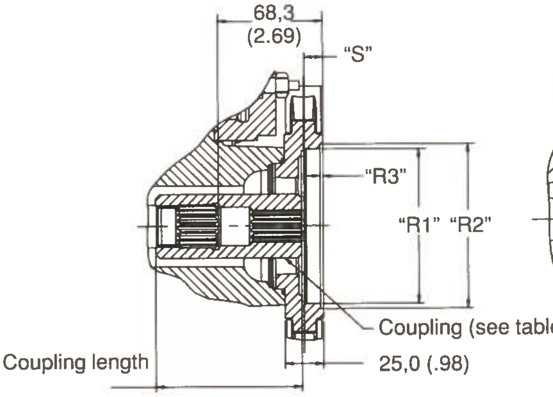

Lifting point .375-16 UNC thd. 10.0 deep with SAE drain M10 x 10.00 deep with ISO drain
Alt. drain port "F". See options on page 61.
95,0 (3.74) (2 plcs)
33.9 (1.33)
115,5 (4.55)
342,4 w/o max adj stop (13.48)
357,8 (14.09)


Inlet port "B". See options on page 60.
To mounting face
276,9 (10.90)
Max. adj. stop. One rotation will change displacement 8,7 – 9,5 L/min (2.3 – 2.5 USgpm) at 1800 rpm. Turn CCW to reduce displacement.
44,45 (1.75)
92,5 (3.64)
90,0 (3.54)
88,9 (3.50)
25,4 (1.00)
50,8 (2.00)
SAE .500-13 UNC-2B thd. 1.19 deep min. ISO M12 x 31.0 deep min.
Alt. drain port "F". See options on page 61.
Inlet gauge port "K". See options on page 61.
16,4 (0.65)
133,7 (5.26)
70,0 (2.76)
70,0 (2.76)
98,0 (3.86)
91,0 (3.58)
119,0 (4.69)
119,0 (4.69)
Load sense port "J". See options on page 61.
Outlet gauge port "K". See options on page 61.
SAE .375-16 UNC-2B thd. .88 deep min. ISO M10 x 23.0 deep min.
247,2 (9.73)
155,7 (6.13)
C/G location
145,1 (5.71)
77,8 (3.06)
37,0 (1.46)
52,37 (2.06)
35,5 (1.40)
26,18 (1.03)
13,1 (0.52)
26,19 (1.03)
Drain port "F". See options on page 61.
194,5 (7.66)
266,9 (10.51)
304,9 (12.00)
321,9 (12.67)
Outlet port "C". See options on page 60.
Start on page 55 for shaft and mounting flange dimensions.

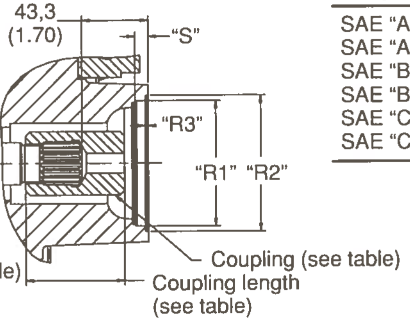
Right hand rotation with "CV" compensator

PVQ106 Thru-drive Models

Dimensions in millimeters (inches)



With adapter plate

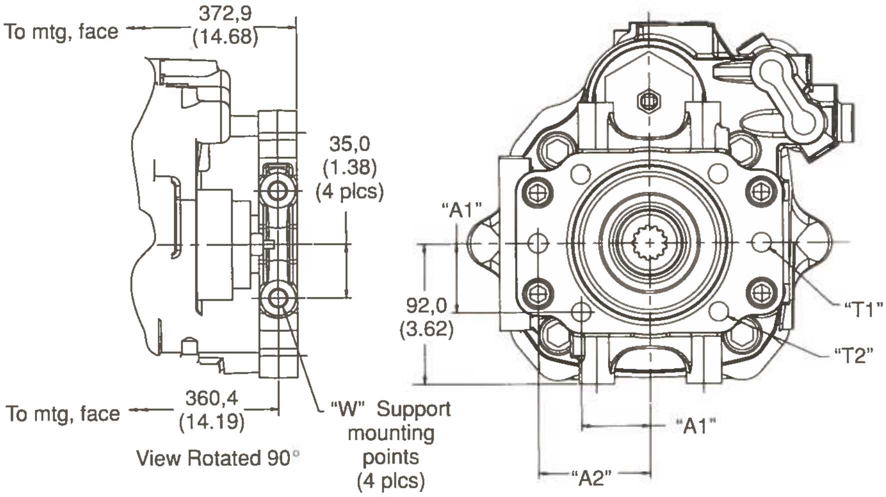


Without adapter plate

Coupling length	
SAE "A", 9T	64,5 (2.54)
SAE "A", 11T	65,3 (2.57)
SAE "B", 13T	95,3 (3.75)
SAE "B-B", 15T	95,3 (3.75)
SAE "C", 14T	95,3 (3.75)
SAE "C-C", 17T	91,8 (3.61)

Coupling Code	Description
A9	SAE "A", 9T, 16/32 DP, 30° pressure angle involute spline.
A11	SAE "A", 11T, 16/32 DP, 30° pressure angle involute spline.
B13	SAE "B", 13T, 16/32 DP, 30° pressure angle involute spline.
B15	SAE "B-B", 15T, 16/32 DP, 30° pressure angle involute spline.
C14	SAE "C", 14T, 12/24 DP, 30° pressure angle involute spline.
C17	SAE "C-C", 17T, 12/24 DP, 30° pressure angle involute spline.
MA9	For ISO 80-A2HW pad with a 9T SAE spline.
MA11	For ISO 80-A2HW pad with a 11T SAE spline.
MB13	For ISO 100-A2/B4HW pad with a 13T SAE spline.
MB15	For ISO 100-A2/B4HW pad with a 15T SAE spline.
MC14	For ISO 125-A2/B4HW pad with a 14T SAE spline.
MC17	For ISO 125-A2/B4HW pad with a 17T SAE spline.

"B" Adapter Flange



Right hand rotation with "CV" compensation and ISO or SAE 2/4 bolt "B" adapter flange

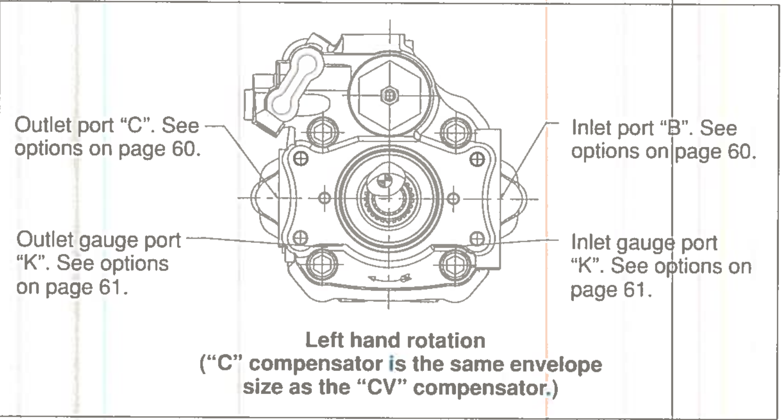
Adapter	Flange	Bolt	Pilot Dia. "R1"	O-ring Dia. "R2"	O-ring Depth "R3"	Pilot Depth "S"	2-bolt "T1"	4-bolt "T2"	Support Mtg. Points "W"	4-bolt "A1"	2-bolt "A2"
None	SAE "A" 2-bolt	SAE	Ø82,6 (3.25)	Ø89,65 (3.53)	2,00 (.08) 1,90 (.07)	9,0/8,0 (.35/.31)	.375-16 UNC-2B thd 0.59 deep	N/A	N/A	N/A	53,2 (2.09)
		ISO					M10 thd x 18,0 deep	N/A	N/A	N/A	
	ISO 80	ISO	Ø80,05 (3.15)	Ø89,75 (3.53)	2,70 (.11) 2,60 (.10)	9,0/8,0 (.35/.31)	M10 thd x 18,0 deep	N/A	N/A	N/A	54,5 (2.15)
B	SAE "B" 2/4 bolt	SAE	Ø101,65 (4.00)	Ø108,05 (4.25)	2,00 (.08) 1,90 (.07)	12,5/11,5 (.49/.45)	.50-13 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep	44,9 (1.77)	73,0 (2.87)
		ISO					M12 thd.	M12 thd.	M12 thd x 25,0 deep		
	ISO 100	ISO	Ø100,05 (3.94)	Ø108,75 (4.28)	2,70 (.11) 2,60 (.10)	12,5/11,5 (.49/.45)	M12 thd.	M10 thd.	M12 thd x 25,0 deep	44,19 (1.74)	70,0 (2.76)

PVQ106 Thru-drive Models

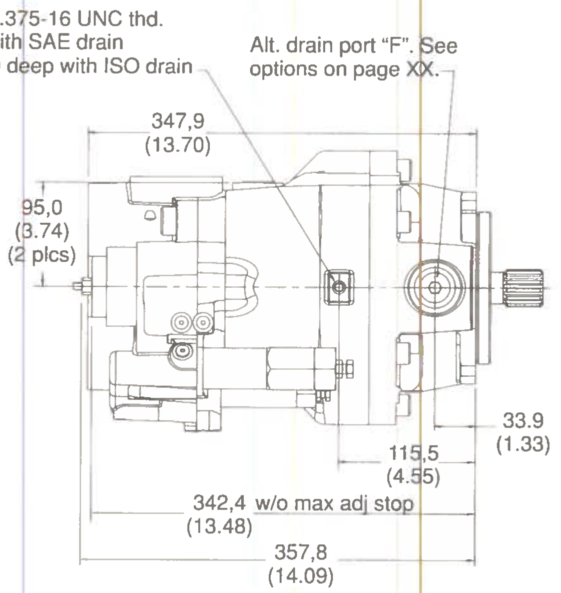
Dimensions in millimeters (inches)

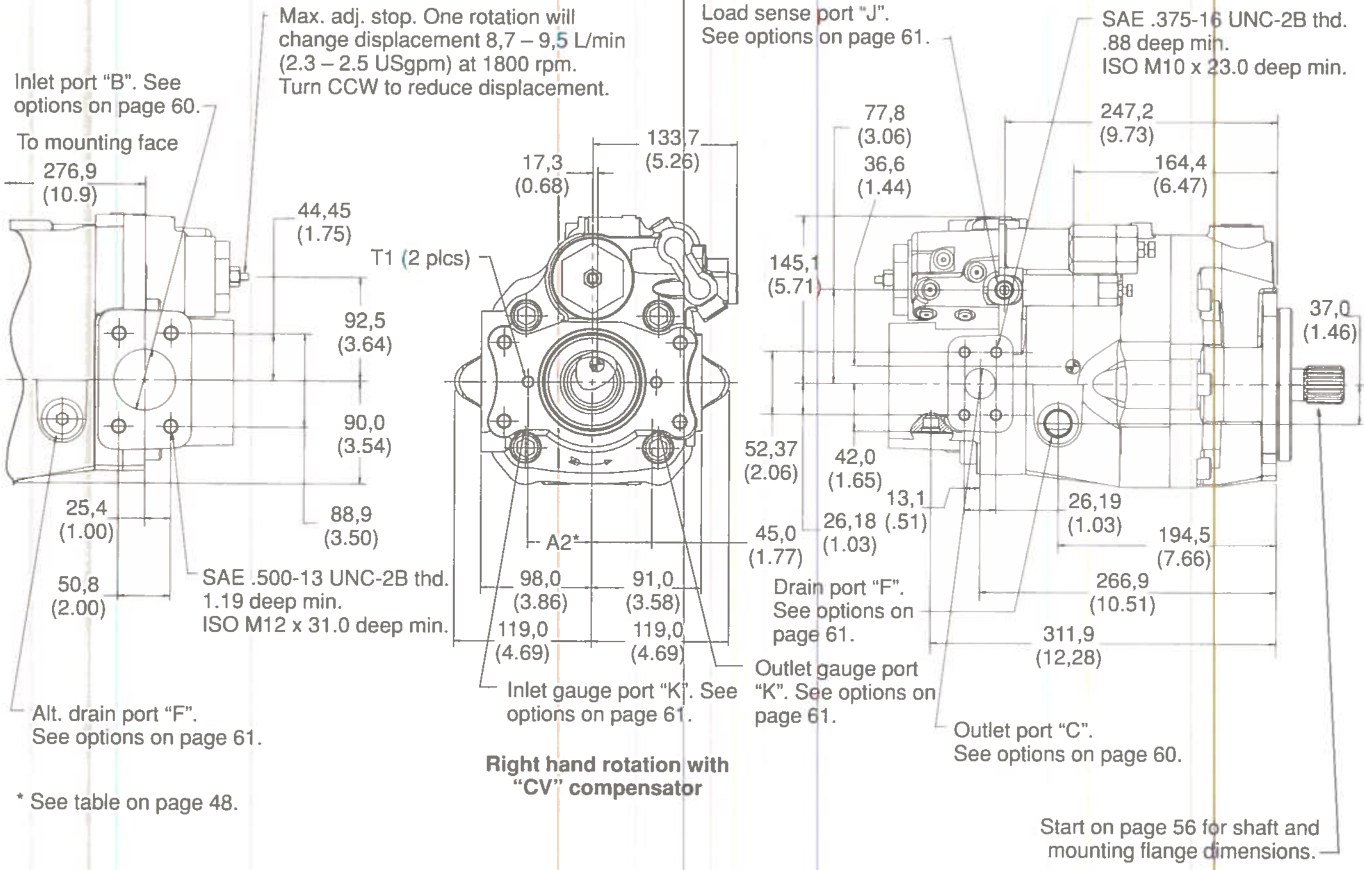
See mounting flange options on page 55.

Start on page 56 for shaft options.


Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.
Outlet gauge port "K". See options on page 61.
Inlet gauge port "K". See options on page 61.

Left hand rotation
("C" compensator is the same envelope size as the "CV" compensator.)



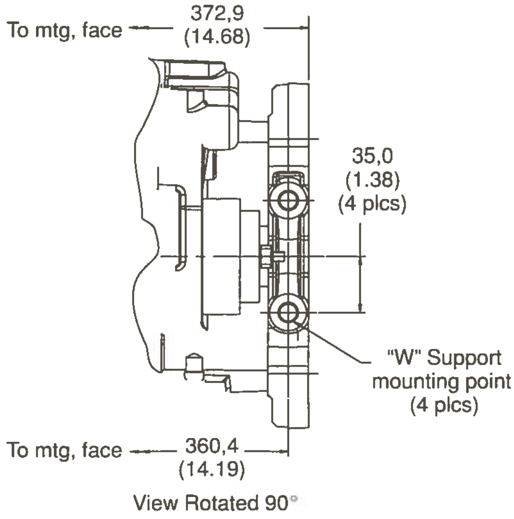


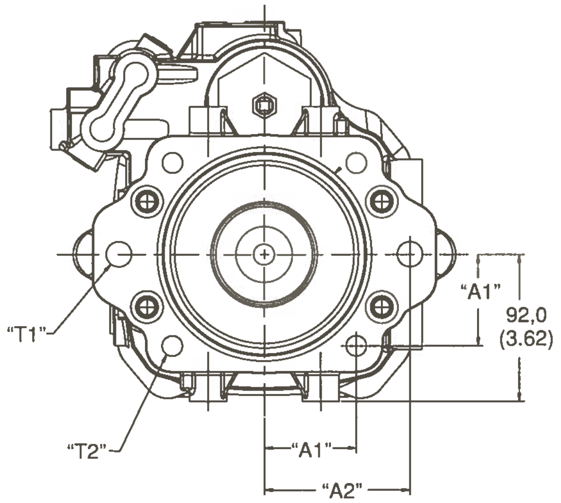
Right hand rotation with "CV" compensator

* See table on page 48.

Dimensions in millimeters (inches)

"C" Adapter Flange





Left hand rotation with "CV" compensator and ISO or SAE 2/4 bolt "C" adapter flange

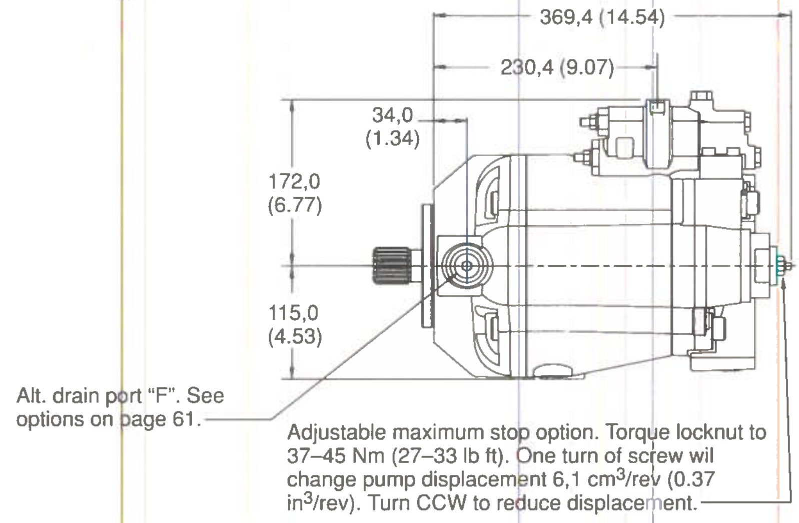
Adapter	Flange	Bolt	Pilot Dia.	O-ring Dia.	O-ring Depth	Pilot Depth	2-bolt	4-bolt	Support Mtg. Points	4-bolt	2-bolt
			"R1"	"R2"	"R3"	"S"	"T1"	"T2"	"W"	"A1"	"A2"
C	SAE "C" 2/4 bolt	SAE	127,05 (5.00)	Ø133,45 (5.25)	2,00 (.08) 1,90 (.07)	15,5/14,5 (.61/.57)	.625-11 UNC-2B thd	.50-13 UNC-2B thd	.50-13 UNC-2B thd. .98" deep	57,25 (2.25)	90,5 (3.56)
		ISO					M16 thd.	M12 thd.	M12 thd x 25,0 deep		
	ISO 125	ISO	Ø125,05 (4.92)	Ø133,75 (5.27)	2,70 (.11) 2,60 (.10)	15,5/14,5 (.61/.57)	M16 thd.	M12 thd.	M12 thd x 25,0 deep	56,57 (2.23)	90,0 (3.54)

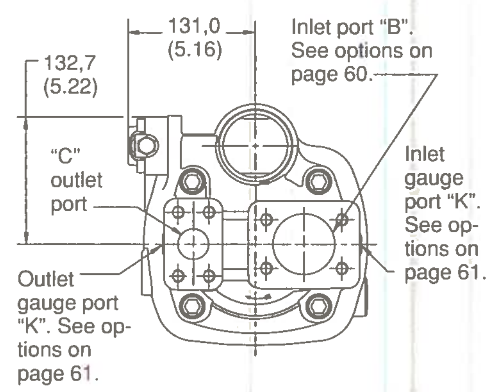
PVQ141 End-ported Models

Dimensions in millimeters (inches)

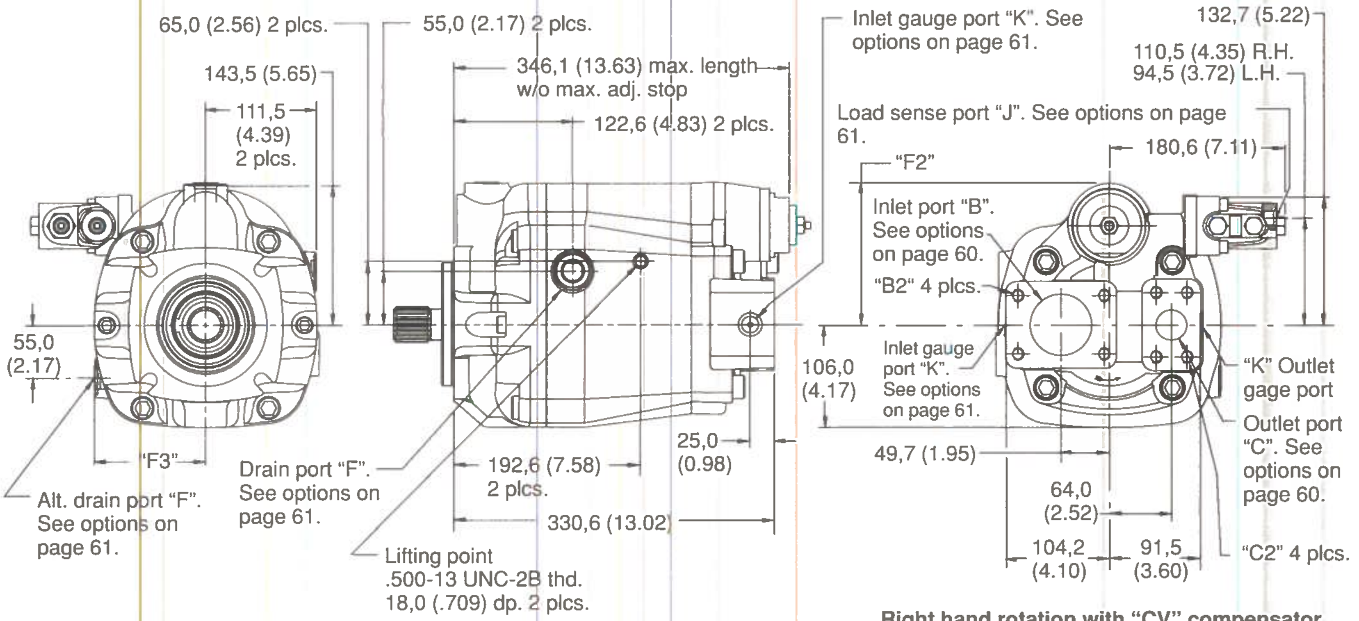
See mounting flange options on page 55.

Start on page 56 for shaft options.


369,4 (14.54)
230,4 (9.07)
34,0 (1.34)
172,0 (6.77)
115,0 (4.53)
Alt. drain port "F". See options on page 61.
Adjustable maximum stop option. Torque locknut to 37–45 Nm (27–33 lb ft). One turn of screw wil change pump displacement 6,1 cm³/rev (0.37 in³/rev). Turn CCW to reduce displacement.


131,0 (5.16)
132,7 (5.22)
Inlet port "B". See options on page 60.
"C" outlet port
Inlet gauge port "K". See options on page 61.
Outlet gauge port "K". See options on page 61.

Left hand rotation with "C' compensator


65,0 (2.56) 2 plcs.
55,0 (2.17) 2 plcs.
143,5 (5.65)
111,5 (4.39) 2 plcs.
346,1 (13.63) max. length w/o max. adj. stop
122,6 (4.83) 2 plcs.
55,0 (2.17)
"F3"
Alt. drain port "F". See options on page 61.
Drain port "F". See options on page 61.
192,6 (7.58) 2 plcs.
25,0 (0.98)
330,6 (13.02)
Lifting point .500-13 UNC-2B thd. 18,0 (.709) dp. 2 plcs.
Inlet gauge port "K". See options on page 61.
132,7 (5.22)
110,5 (4.35) R.H.
94,5 (3.72) L.H.
Load sense port "J". See options on page 61.
"F2"
180,6 (7.11)
Inlet port "B". See options on page 60.
"B2" 4 plcs.
Inlet gauge port "K". See options on page 61.
106,0 (4.17)
49,7 (1.95)
64,0 (2.52)
104,2 (4.10)
91,5 (3.60)
"K" Outlet gage port
Outlet port "C". See options on page 60.
"C2" 4 plcs.

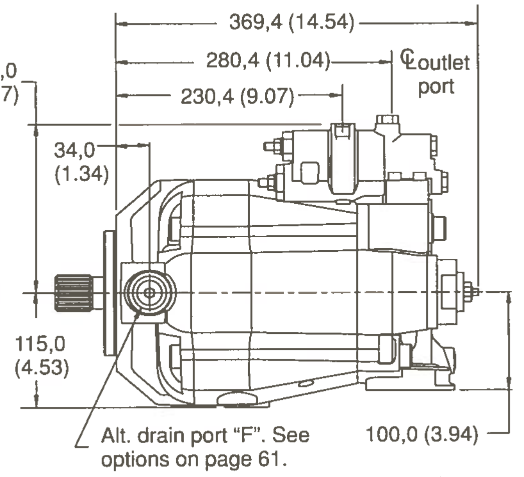
Right hand rotation with "CV" compensator

Port	"B"*	"B2"	"C"*	"C2"	"F2"	"F3"
SAE	2.50 inch dia. SAE J518 Code 61, low pressure.	.500–13 UNC–2B thd. 1.19 deep minimum	1.25 inch dia. SAE J518 Code 62, high pressure.	.500–13 UNC–2B thd. 1.00 deep minimum	146,8 (5.78)	114,9 (4.52)
ISO	64 mm diameter. ISO 6162 Type II, 315 bar.	M12 thread 31,0 deep minimum	32 mm diameter. ISO 6162, 400 bar.	M12 thread 27,0 deep minimum	148,5 (5.85)	116,6 (4.59)

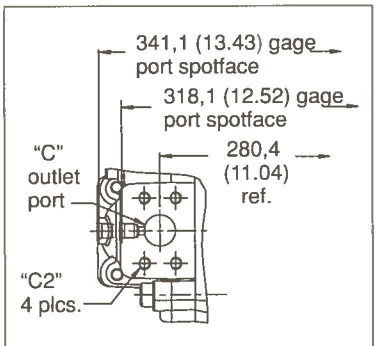
***4-bolt flange port. See page 60 for load sensing, drain, and gage port threads.**

Dimensions in millimeters (inches)

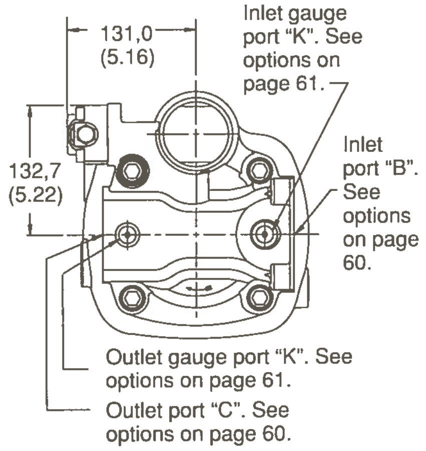
See mounting flange options on page 55.
Start on page 56 for shaft options.



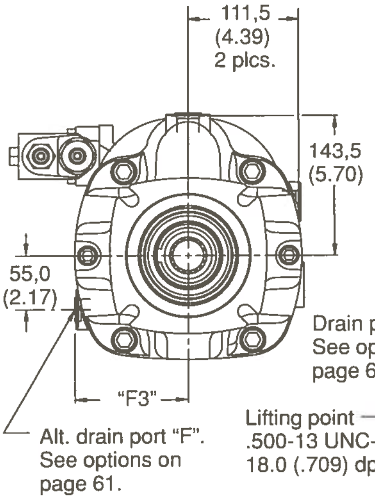
Adjustable maximum stop option. Torque locknut to 37–45 Nm (27–33 lb ft). One turn of screw wil change pump displacement 6,1 cm³/rev (0.37 in³/rev). Turn CCW to reduce displacement.

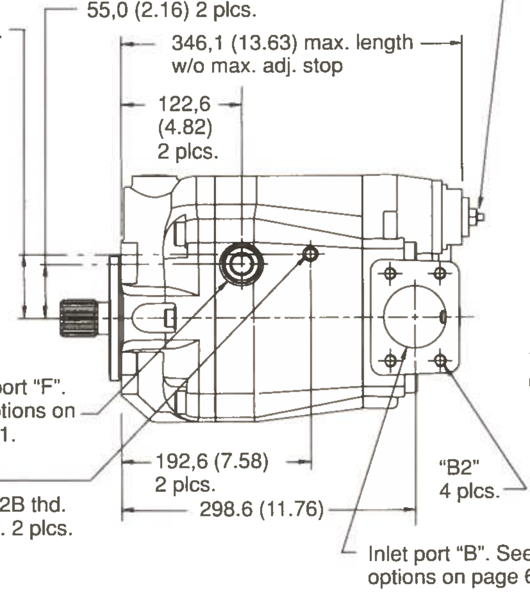

341,1 (13.43) gage port spotface
318,1 (12.52) gage port spotface
280,4 (11.04) ref.
"C" outlet port
"C2" 4 plcs.

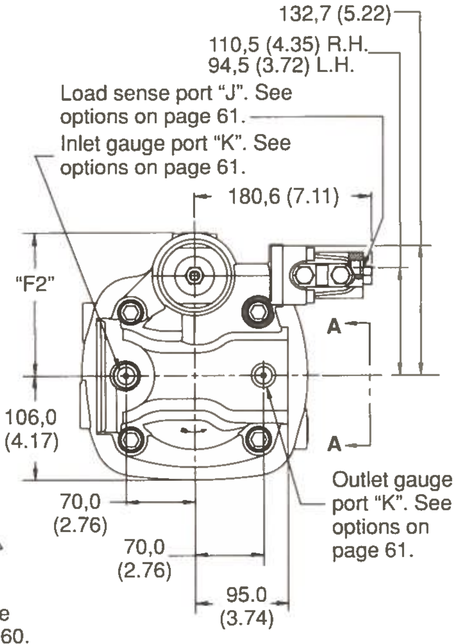
View A – A Outlet port


131,0 (5.16)
Inlet gauge port "K". See options on page 61.
132,7 (5.22)
Inlet port "B". See options on page 60.
Outlet gauge port "K". See options on page 61.
Outlet port "C". See options on page 60.

Left hand rotation with "C" compensator




65,0 (2.56) 2 plcs.
55,0 (2.16) 2 plcs.
346,1 (13.63) max. length w/o max. adj. stop
122,6 (4.82) 2 plcs.
Drain port "F". See options on page 61.
Lifting point .500-13 UNC-2B thd. 18.0 (.709) dp. 2 plcs.
192,6 (7.58) 2 plcs.
298.6 (11.76)
"B2" 4 plcs.
Inlet port "B". See options on page 60.


132,7 (5.22)
110,5 (4.35) R.H.
94,5 (3.72) L.H.
Load sense port "J". See options on page 61.
Inlet gauge port "K". See options on page 61.
180,6 (7.11)
"F2"
A
A
106,0 (4.17)
70,0 (2.76)
70,0 (2.76)
95.0 (3.74)
Outlet gauge port "K". See options on page 61.

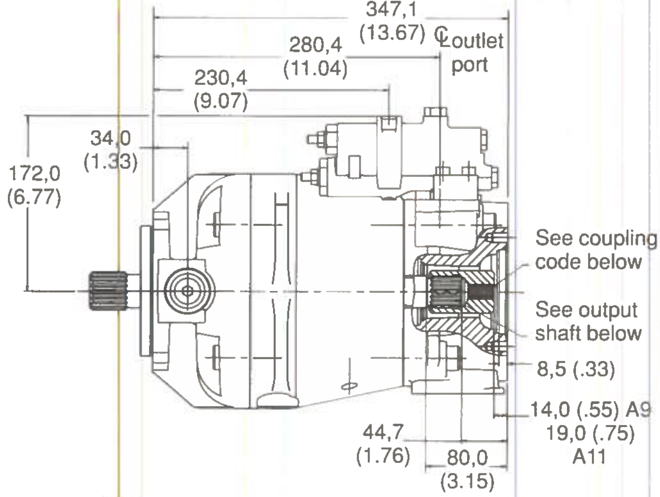
Right hand rotation with "CV" compensator

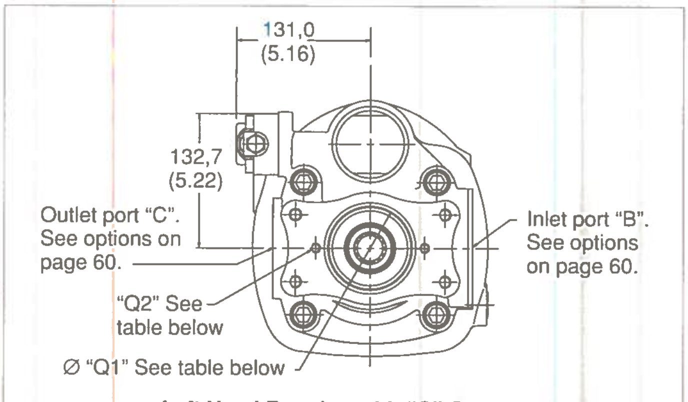
Port	"B"*	"B2"	"C"*	"C2"	"F2"	"F3"
SAE	2.50 inch dia. SAE J518 Code 61, low pressure.	.500–13 UNC–2B thd. 1.19 deep minimum	1.25 inch dia. SAE J518 Code 62, high pressure.	.500–13 UNC–2B thd. 1.00 deep minimum	146,8 (5.78)	114,9 (4.52)
ISO	64 mm diameter. ISO 6162 Type II, 315 bar.	M12 thread 31,0 deep minimum	32 mm diameter. ISO 6162, 400 bar.	M12 thread 27,0 deep minimum	148,5 (5.85)	116,6 (4.59)

***4-bolt flange port. See page 60 for load sensing, drain, and gage port threads.**

PVQ141 Thru-drive Models

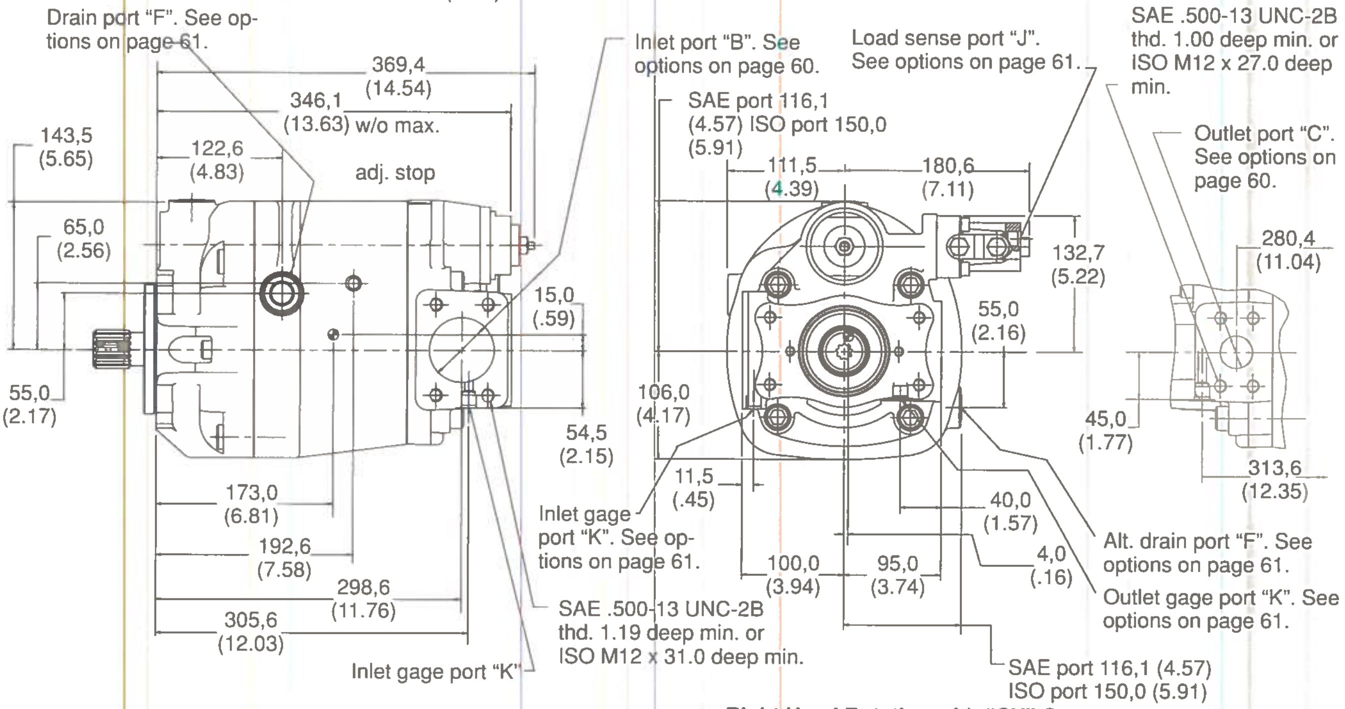
Dimensions in millimeters (inches)
See mounting flange options on page 55.
Start on page 56 for shaft options.





131,0
(5.16)
132,7
(5.22)
Outlet port "C". See options on page 60.
Inlet port "B". See options on page 60.
"Q2" See table below
Ø "Q1" See table below

Left Hand Rotation with "C" Compensator and SAE 2-bolt "A" Flange (no adapter)



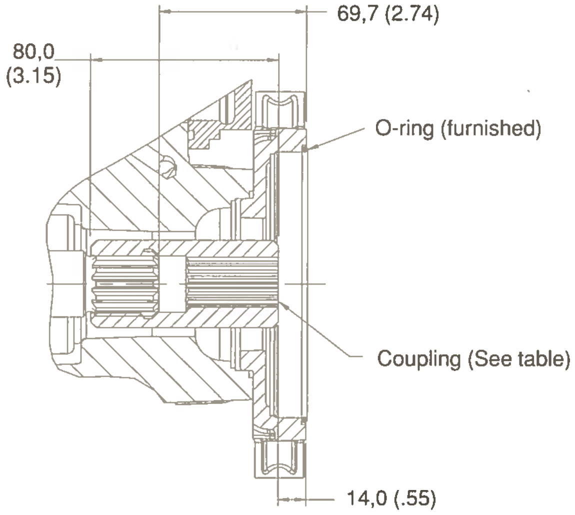
Drain port "F". See options on page 61.
369,4
(14.54)
346,1
(13.63) w/o max.
adj. stop
143,5
(5.65)
122,6
(4.83)
65,0
(2.56)
55,0
(2.17)
15,0
(.59)
54,5
(2.15)
173,0
(6.81)
192,6
(7.58)
298,6
(11.76)
305,6
(12.03)
Inlet gage port "K"
Inlet port "B". See options on page 60.
SAE port 116,1 (4.57) ISO port 150,0 (5.91)
Load sense port "J". See options on page 61.
SAE .500-13 UNC-2B thd. 1.00 deep min. or ISO M12 x 27.0 deep min.
Outlet port "C". See options on page 60.
111,5
(4.39)
180,6
(7.11)
132,7
(5.22)
55,0
(2.16)
280,4
(11.04)
106,0
(4.17)
45,0
(1.77)
313,6
(12.35)
11,5
(.45)
Inlet gage port "K". See options on page 61.
40,0
(1.57)
4,0
(.16)
100,0
(3.94)
95,0
(3.74)
Alt. drain port "F". See options on page 61.
Outlet gage port "K". See options on page 61.
SAE .500-13 UNC-2B thd. 1.19 deep min. or ISO M12 x 31.0 deep min.
SAE port 116,1 (4.57) ISO port 150,0 (5.91)

Right Hand Rotation with "CV" Compensator and SAE 2-bolt "A" Flange (no adapter)

Model Code	"Q1" Thru-drive Flange	"Q2" 2-bolt Thread
PV*-*-A*F*	SAE J744-82-2 Ø82.625/82.575 bore	.375 - 16 UNC-2B thd. 0.80 deep
PV*-*-A*M*	SAE J744-82-2 Ø82.625/82.575 bore	M10 thd x 18,0 deep
PV*-*-MA*M*	ISO 3019/2-80A2 Ø80.075/80.25 bore	M10 thd x 18,0 deep

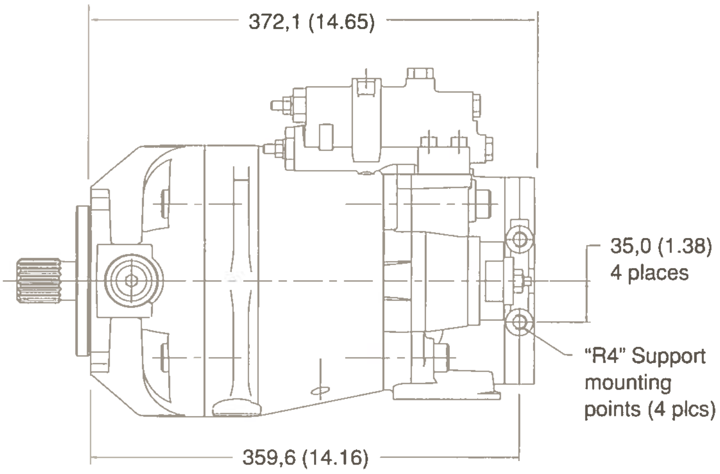
Coupling Code	Description
A9	For SAE "A" pad with a 9T, 16/32 DP, 30° Press. angle, involute spline.
A11	For SAE "A" pad with a 11T, 16/32 DP, 30° Press. angle, involute spline.
Output shaft	14T 12/24 DP external involute spline

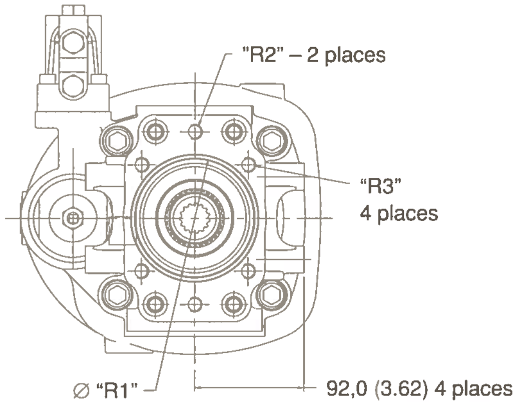
Dimensions in millimeters (inches)



Coupling Code	Description
B13	SAE "B", 13T, 16/32 DP, 30° pressure angle involute spline.
B15	SAE "B-B", 15T, 16/32 DP, 30° pressure angle involute spline.
C14	SAE "C", 14T, 12/24 DP, 30° pressure angle involute spline.
C17	SAE "C-C", 17T, 12/24 DP, 30° pressure angle involute spline.
MA9	For ISO 80-A2HW pad with a 9T SAE spline.
MA11	For ISO 80-A2HW pad with a 11T SAE spline.
MB13	For ISO 100-A2/B4HW pad with a 13T SAE spline.
MB15	For ISO 100-A2/B4HW pad with a 15T SAE spline.
MC14	For ISO 125-A2/B4HW pad with a 14T SAE spline.
MC17	For ISO 125-A2/B4HW pad with a 17T SAE spline.

"B" Adapter Flange



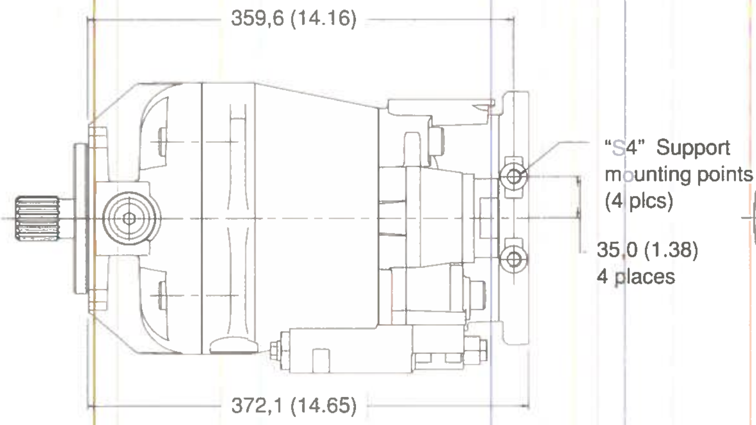


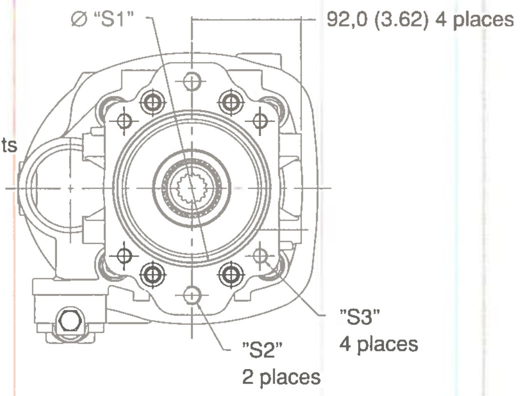
Right Hand Rotation with SAE 2/4 Bolt "B" Flange and ISO 100Adapter Flange

Model Code	"R1" Thru-drive Flange	"R2" 2-bolt Thread	"R3" 4-bolt Thread	"R4" Support Mtg. Point
PV*-*-B*F*	SAE J744-101-2 & -4 ∅101,675/101.625 bore 12,50/11,50 deep	.500 - 13 UNC-2B 0.98 deep	.500 - 13 UNC-2B 0.98 deep	.500 - 13 UNC-2B 0.98 deep
PV*-*-B*M*	SAE J744-101-2 & -4 ∅101,675/101.625 bore 12,50/11,50 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep
PV*-*-MB*M*	ISO 3019/2-100A2 & B2 ∅100,075/100.025 bore 12,50/11,50 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep

Dimensions in millimeters (inches)

"C" Adapter Flange



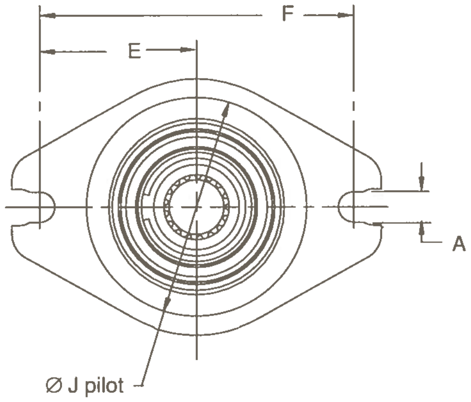


Left Hand Rotation with SAE 2/4 bolt "C" and ISO 125 Adapter Flange

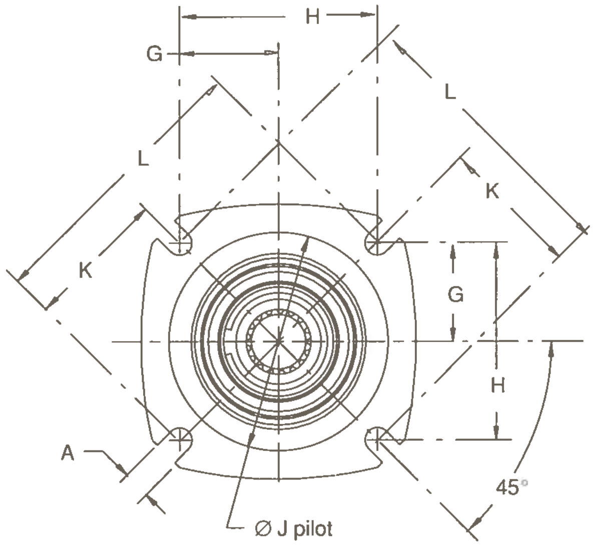
Model Code	"S1" Thru-drive Flange	"S2" 2-bolt Thread	"S3" 4-bolt Thread	"S4" Support Mtg. Points
PV*-*-C*F*	SAE J744-127-2 & -4 Ø127,075/127.025 bore 15,50/14,50 deep	.625 - 11 UNC-2B 0.98 deep	.500 - 13 UNC-2B 0.98 deep	.500 - 13 UNC-2B 0.98 deep
PV*-*-C*M*	SAE J744-127-2 & -4 Ø127,075/127.025 bore 15,50/14,50 deep	M16 thd x 25,0 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep
PV*-*-MC*M*	ISO 3019/2-125A2 & B4 Ø125,075/125.025 bore 15,50/14,50 deep	M16 thd x 25,0 deep	M12 thd x 25,0 deep	M12 thd x 25,0 deep

Dimensions in millimeters (inches)

2-bolt “C” Flange
ISO & SAE



2-bolt “B” Flange
4-bolt “C” or “D” Flange
ISO & SAE



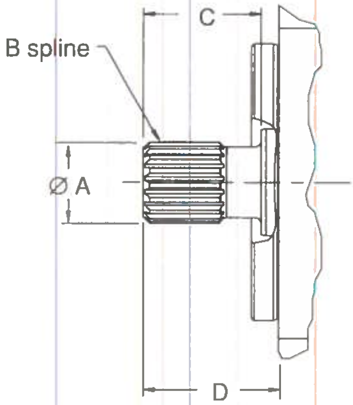
Model Series	2-bolt or 4-bolt Flange	Flange Designation	A	E	F	G	H	J	K	L
PVQ63	2-bolt “B” (special)	SAE J744-101-2 (“B”) Flange Code B2	14,3 (.562)	–	–	–	–	Ø101,60/101,55 (Ø4.000/3.998)	73,0 (2.874)	146,0 (5.748)
		ISO 3019/2–100A2HW Flange Code MB2	14,0 (.551)	–	–	–	–	Ø100,00/99,95 (Ø3.937/3.935)	70,0 (2.756)	140,0 (5.512)
PVQ63 PVQ81 PVQ106 PVQ141	2-bolt “C”	SAE J744-127-2 (“C”) Flange Code C2	17,4 (.685)	90,5 (3.562)	181,0 (7.125)	–	–	Ø127,00/126,95 (Ø5.000/4.998)	–	–
		ISO 3019/2–125A2HW Flange Code MC2	18,0 (.709)	90,0 (3.543)	180,0 (7.09)	–	–	Ø 125,00/124,95 (Ø 4.921/4.919)	–	–
	4-bolt “C”	SAE J744-127-4 (“C”) Flange Code C4	14.2 (.559)	–	–	57,25 (2.254)	114,50 (4.508)	Ø127,00/126,95 (Ø5.000/4.998)	–	–
		ISO 3019/2–125B4HW Flange Code MC4	14,0 (.551)	–	–	–	–	Ø 125,00/124,95 (Ø 4.921/4.919)	80,0 (3.150)	160,0 (6.299)
PVQ141	4-bolt “D”	SAE J744-152-4 (“D”) Flange Code D4	20,6 (.812)	–	–	80,82 (3.182)	161,64 (6.364)	Ø152,40/152,35 (Ø6.000/5.998)	–	–
		ISO 3019/2–160B4HW Flange Code MD4	18,0 (.709)	–	–	–	–	Ø 160,00/159,95 (Ø 6.299/6.297)	100,0 (3.937)	200,0 (7.874)

* Flanges for PVQ20 and PVQ50 are shown on pages 23 and 29, respectively.

Shaft Options

Dimensions in millimeters (inches)

SAE Splined Shaft



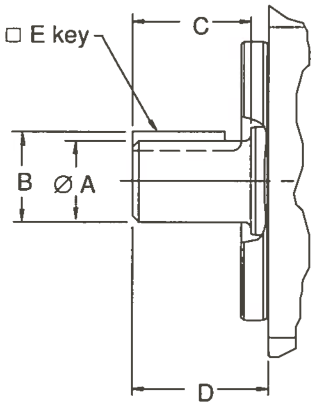
Model Series	SAE Splined Shaft Designation	Shaft Code	A max.	B	C	D	Max. Input Torque* Nm (lb. in.)
PVQ20	SAE J744-16-4 SAE "A" (9T)	3	15,88 (.625)	9T 16/32 DP	37,0 (1.46)	32,0 (1.26)	58 (517)
	SAE J744-19-4 SAE "A" (11T)	4	19,05 (.750)	11T 16/32 DP	30,0 (1.18)	38,0 (1.50)	123 (1100)
	SAE J744-22-4 SAE "B" (13T)	7	21,82 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE "B-B" (15T)	8	24,99 (.984)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
PVQ50	SAE J744-22-4 SAE "B" (13T)	3	21,82 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE "B-B" (15T)	4	24,99 (.984)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
PVQ63	SAE J744-22-4 SAE "B" (13T)	7	21,82 (.859)	13T 16/32 DP	33,0 (1.31)	41,0 (1.61)	208 (1850)
	SAE J744-25-4 SAE "B-B" (15T)	8	24,99 (.984)	15T 16/32 DP	38,0 (1.50)	46,0 (1.81)	337 (2987)
	SAE J744-32-4 SAE "C" (14T)	3	31,22 (1.229)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
PVQ81 PVQ106	SAE J744-32-4 SAE "C" (14T)	3	31,22 (1.229)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
	SAE J744-38-4 SAE "C-C" (17T)	4	37,57 (1.479)	17T 12/24 DP	54,0 (2.13)	62,0 (2.44)	1215 (10,750)
PVQ141	SAE J744-32-4 SAE "C" (14T)	3	31,22 (1.229)	14T 12/24 DP	48,0 (1.89)	56,0 (2.20)	640 (5660)
	SAE J744-38-4 SAE "C-C" (17T)	4	37,57 (1.479)	17T 12/24 DP	54,0 (2.13)	62,0 (2.44)	1215 (10,750)
	SAE J744-44-4 SAE "D" (13T)	6	43,71 (1.721)	13T 8/16 DP	67,0 (2.63)	75,0 (2.95)	1215 (10,750)

* Torque of non-thru-drive PVQ pump, or combined torque of PVQ thru-drive pump and thru-driven pump.

NOTE: In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Vickers Engineering department for specific limits.

Dimensions in millimeters (inches)

SAE Keyed Shaft



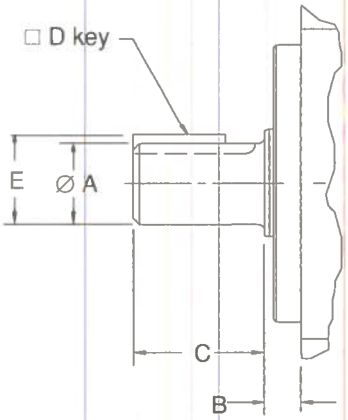
Model Series	SAE Keyed Shaft Designation	Shaft Code	A	B	C	D	E	Max. Input Torque* Nm (lb. in.)
PVQ20	SAE J744-16-1 SAE "A"	1	15,88 (.625)	17,60 (.693)	24,0 (.945)	32,0 (1.26)	3,99 (.157)	58 (517)
	SAE J744-19-1 SAE "A"	2	19,05 (.750)	21,10 (.831)	24,0 (.945)	32,0 (1.26)	4,80 (.189)	104 (918)
	SAE J744-22-1 SAE "B"	5	22,22 (.875)	25,12 (.989)	33,0 (1.31)	41,0 (1.61)	6,35 (.250)	135 (1200)
	SAE J744-25-1 SAE "B-B"	6	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6.35 (.250)	215 (1900)
PVQ50	SAE J744-22-1 SAE "B"	1	22,22 (.875)	25,12 (.989)	33,0 (1.31)	41,0 (1.61)	6,35 (.250)	135 (1200)
	SAE J744-25-1 SAE "B-B"	2	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6.35 (.250)	215 (1900)
PVQ63	SAE J744-25-1 SAE "B-B"	6	25,37 (.999)	28,22 (1.111)	38,0 (1.50)	46,0 (1.81)	6.35 (.250)	215 (1900)
	SAE J744-32-1 SAE "C"	1	31,75 (1.25)	35,32 (1.39)	48,0 (1.89)	56,0 (2.20)	7,93 (.312)	450 (3980)
PVQ81 PVQ106	SAE J744-32-1 SAE "C"	1	31,75 (1.25)	35,32 (1.39)	48,0 (1.89)	56,0 (2.20)	7,97 (.313)	450 (3980)
	SAE J744-38-1 SAE "C-C"	2	38,10 (1.50)	42,40 (1.67)	54,0 (2.12)	62,0 (2.44)	9,55 (.376)	765 (6770)
PVQ141	SAE J744-32-1 SAE "C"	1	31,75 (1.25)	35,32 (.989)	48,0 (1.89)	56,0 (2.20)	7,93 (.312)	450 (3980)
	SAE J744-38-1 SAE "C-C"	2	38,10 (1.50)	42,39 (1.67)	54,0 (2.12)	62,0 (2.44)	9,52 (.375)	765 (6770)
	SAE J744-44-1 SAE "D"	5	44,45 (1.75)	49,46 (1.95)	67,0 (2.64)	75,0 (2.95)	11,11 (.438)	1200 (10,620)

* Torque of non-thru-drive PVQ pump, or combined torque of PVQ thru-drive pump and thru-driven pump.

NOTE: In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Vickers Engineering department for specific limits.

Dimensions in millimeters (inches)

ISO Keyed Shaft



Model Series	ISO Keyed Shaft Designation	Shaft Code	A	B	C	D	E	Max. Input Torque* Nm (lb. in.)
PVQ20	ISO 3019/2 E20N	N1(1)	19,9 (.786)	8,5 (.335)	36 (1.42)	6 (.236)	22,5 (.886)	113 (1000)
	ISO 3019/2 E25N	N2(1)	25 (.984)	8,5 (.335)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
	ISO 3019/2 E25N	N3(2)	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
PVQ50	ISO 3019/2 E25N	N1	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
PVQ63	ISO 3019/2 E25N	N3	25 (.984)	10 (.393)	42 (1.65)	8 (.315)	28,0 (1.102)	215 (1900)
	ISO 3019/2 E32N	N1	32 (1.26)	10 (.393)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
PVQ81	ISO 3019/2 E32N	N1	32 (1.26)	10,5 (.413)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
PVQ106	ISO 3019/2 E40N	N2	40 (1.57)	10,5 (.413)	82 (3.23)	12 (.472)	43,0 (1.693)	870 (7700)
PVQ141	ISO 3019/2 E32N	N1	32 (1.26)	10 (.393)	58 (2.28)	10 (.394)	35,0 (1.378)	450 (3980)
	ISO 3019/2 E40N	N2	40 (1.57)	10 (.393)	82 (3.23)	12 (.472)	43 (1.693)	765 (6770)

(1) ISO 80mm pilot only – MA2
(2) ISO 100mm pilot only – MB2
* Torque of non-thru-drive PVQ pump, or combined torque of PVQ thru-drive pump and thru-driven pump.

NOTE: In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Vickers Engineering for specific limits.

Input Shaft Selection Data PVQ700 Family

SAE Splined Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVQ20	SAE J744-16-4 (SAE "A", 9T)	3	58 (513)	–
	SAE J744-19-4 (SAE "A", 11T)	4	123 (1088)	–
	SAE J744-22-4 (SAE "B", 13T)	7	208 (1850)	123 (1100)
	SAE J744-25-4 (SAE "B-B", 15T)	8	337 (2987)	123 (1100)
PVQ50	SAE J744-22-4 (SAE "B", 13T)	3	208 (1850)	208 (1850)*
	SAE J744-25-4 (SAE "B-B" 15T)	4	337 (2987)	337 (2987)
PVQ63	SAE J744-22-4 (SAE "B" 13T)	7	208 (1850)	208 (1850)*
	SAE J744-25-4 (SAE "B-B" 15T)	8	337 (2987)	337 (2987)
	SAE J744-32-4 (SAE "C" 14T)	3	640 (5660)	337 (2987)
PVQ81 PVQ106	SAE J744-32-4 (SAE "C" 14T)	3	640 (5660)	515 (4560)
	SAE J744-38-4 (SAE "C-C" 17T)	4	1215 (10,750)	PVQ81 515 (4560) PVQ106 515 (4560)
PVQ141	SAE J744-32-4 (SAE "C" 14T)	3	640 (5660)	640 (5660)
	SAE J744-38-4 (SAE "C-C" 17T)	4	1215 (10,750)	640 (5660)
	SAE J744-44-4 (SAE "D" 13T)	6	1700 (15,000)	640 (5660)

SAE Keyed Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVQ20	SAE J744-16-1 SAE "A"	1	58 (513)	–
	SAE J744-19-1 SAE "A"	2	104 (920)	–
	SAE J744-22-1 SAE "B"	5	135 (1200)	123 (1100)
	SAE J744-25-1 SAE "B-B"	6	215 (1900)	123 (1100)
PVQ50	SAE J744-22-1 SAE "B"	1	135 (1200)	135 (1200)*
	SAE J744-25-1 SAE "B-B"	2	215 (1900)	215 (1900)*
PVQ63	SAE J744-25-1 SAE "B-B"	6	215 (1900)	215 (1900)*
	SAE J744-32-1 SAE "C"	1	450 (3980)	337 (2987)
PVQ81 PVQ106	SAE J744-32-1 SAE "C"	1	450 (3980)	450 (3980)*
	SAE J744-38-1 SAE "C-C"	2	765 (6770)	515 (4560)
PVQ141	SAE J744-32-1 SAE "C"	1	450 (3980)	450 (3980)*
	SAE J744-38-1 SAE "C-C"	2	765 (6770)	640 (5660)
	SAE J744-44-1 SAE "D"	5	1200 (10,620)	640 (5660)

ISO Keyed Shafts

Model Series	Shaft Designation	Shaft Code	Max. Input Torque† Nm (lb. in.)	Max. Thru-drive Output Torque‡ Nm (lb. in.)
PVQ20	ISO 3019/2 E20N	N1	113 (1000)	–
	ISO 3019/2 E25N	N2	215 (1900)	–
	ISO 3019/2 E25N	N3	215 (1900)	123 (1100)
PVQ50	ISO 3019/2 E25N	N1	215 (1900)	215 (1900)*
PVQ63	ISO 3019/2 E25N	N3	215 (1900)	215 (1900)*
	ISO 3019/2 E32N	N1	450 (3980)	337 (2987)
PVQ81 PVQ106	ISO 3019/2 E32N	N1	450 (3980)	450 (3980)*
	ISO 3019/2 E40N	N2	870 (7700)	515 (4560)
PVQ141	ISO 3019/2 E32N	N1	450 (3980)	450 (3980)*
	ISO 3019/2 E40N	N2	870 (7700)	640 (5660)

† This is maximum total torque of the thru drive pump and the thru driven pum;p(s).

‡ This is maximum torque which can be applied to the thru driven pump(s).

* This value is limited by the maximum input torque.

Port Options

Inlet and Outlet Ports

Model Series	Inlet/Outlet Port Option (per model code, page 5)	Port Code	Inlet Port "B"	Outlet Port "C"
PVQ20	Inch Flange	F	SAE J518 Code 61, standard pressure. 1.25 inch diameter, .4375-14 x 1.12 bolt holes	SAE J518 Code 61, standard pressure. 0.75 inch diameter, .375-16 x .88 bolt holes
	Metric Flange	M	ISO 6162 Type II, 315 bar. 31,75 mm diameter, M10 x 28 bolt holes	ISO 6162 Type II, 315 bar. 19,05 mm diameter, M10 x 22 bolt holes
	Inch Tube	S	SAE J514 O-ring –20, for 1-$^1/_4$ inch O.D. tube	SAE J514 O-ring –12, for $^3/_4$ inch O.D. tube
	Metric Tube	D	ISO 6149–1, M42 thread	ISO 6149–1, M27 thread
	British Parallel Pipe	B	ISO 228–1:1994 (E), G 1-$^1/_4$ thread	ISO 228–1:1994 (E), G $^3/_4$ thd.
PVQ50	Inch Flange	F	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.06 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375-16 x .87 bolt holes
	Metric Flange	M	ISO 6162 Type II, 315 bar. 51 mm diameter, M12 x 27 bolt holes	ISO 6162 Type II, 315 bar. 25 mm diameter, M10 x 22 bolt holes
	Inch Tube	S	SAE J514 O-ring –24, for 1-$^1/_2$ inch O.D. tube	SAE J514 O-ring –16, for 1 inch O.D. tube
	Metric Tube	D	ISO 6149–1, M48 thread	ISO 6149–1, M33 thread
	British Parallel Pipe	B	ISO 228–1:1994 (E), G 1-$^1/_2$ thread	ISO 228–1:1994 (E), G 1 thread
PVQ63	Inch Flange	F	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.06 bolt holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375-16 x .88 bolt holes
	Metric Flange	M	ISO 6162 Type II, 350 bar. 51 mm diameter, M12 x 29 bolt holes	ISO 6162 Type, 350 bar. 25 mm diameter, M10 x 23 bolt holes
	Inch Tube (End ported models only)	S	SAE J514 O-ring –24, for 1-$^1/_2$ inch O.D. tube	SAE J514 O-ring –16, for 1 inch O.D. tube
	Metric Tube (End ported models only)	D	ISO 6149–1, M48 thread	ISO 6149–1, M33 thread
PVQ81	Inch Flange	F	SAE J518 Code 61, standard pressure. 2.00 inch diameter, .500-13 x 1.19 bolth holes	SAE J518 Code 61, standard pressure. 1.00 inch diameter, .375-16 x .88 bolt holes
	Metric Flange	M	ISO 6162 Type I, 350 bar. 51 mm diameter, M12 x 20 bolt holes	ISO 6162 Type I, 350 bar. 25 mm diameter, M10 x 17 bolt holes
PVQ106	Inch Flange	F	SAE J518 Code 61, standard pressure. 2.50 inch diameter, .500-13 x 1.19 bolt holes	SAE J518 Code 62, high pressure. 1.00 inch diameter, .375-16 x .88 bolt holes
	Metric Flange	M	ISO 6162 Type II, 315 bar. 64 mm diameter, M12 x 31 bolt holes	ISO 6162 Type, 400 bar. 25 mm diameter, M10 x 23 bolt holes
PVQ141	Inch Flange	F	SAE J518 Code 61, standard pressure. 2.50 inch diameter, .500-13 x 1.19 bolt holes	SAE J518 Code 62, high pressure. 1.25 inch diameter, .500-13 x 1.00 bolt holes
	Metric Flange	M	ISO 6162 Type II, 315 bar. 64 mm diameter, M12 x 31 bolt holes	ISO 6162 Type, 400 bar. 32 mm diameter, M12 x 27 bolt holes

Drain, Load Sensing, and Gauge Ports

Model Series	Inlet/Outlet Port Option (per model code, page 5)	Port Code	Drain Port "F"	Load Sensing Port "J"	Gauge Port "K"
PVQ20	Inch Flange or Tube	F, S	SAE J514 O-ring, .50" O.D. tube. .750–16 UNF 2B thread.	SAE J514 O-ring, .25" O.D. tube. .4375–20 UNF 2B thread.	SAE J514 O-ring, .25" O.D. tube. .4375–20 UNF 2B thread.
	Metric Flange or Tube	M, D	ISO 6149–1 O-ring M18 x 1,5 thread	ISO 6149–1 O-ring M12 x 1,5 thread	ISO 6149–1 O-ring M12 x 1,5 thread
	British Parallel Pipe	B	ISO 228–1:1994 (E) G $^{1}/_{2}$ thread	ISO 228–1:1994 (E) G $^{1}/_{4}$ thread	ISO 228–1:1994 (E) G $^{1}/_{4}$ thread
PVQ50	Inch Flange or Tube	F, S	SAE J514 O-ring, .625" O.D. tube. .875–14 UNF 2B thread.	SAE J514 O-ring, .250" O.D. tube. .4375–20 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .5625–18 UNF 2B thread.
	Metric Flange or Tube	M, D	ISO 6149–1 O-ring M22 x 1,5 thread	ISO 6149–1 O-ring M12 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread
	British Parallel Pipe	B	ISO 228–1:1994 (E) G $^{1}/_{2}$ thread	ISO 228–1:1994 (E) G $^{1}/_{4}$ thread	ISO 228–1:1994 (E) G 1/4 thread
PVQ63	Inch Flange or Tube	F, S	SAE J514 O-ring, .625" O.D. tube. .875–14 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .5625–18 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .5625–18 UNF 2B thread.
	Metric Flange or Tube	M, D	ISO 6149–1 O-ring M22 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread
PVQ81 PVQ106	Inch Flange	F	SAE J514 O-ring, .625" O.D. tube. .875–14 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .562–18 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .5625–18 UNF 2B thread.
	Metric Flange	M	ISO 6149–1 O-ring M22 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread
PVQ141	Inch Flange	F	SAE J514 O-ring, .625" O.D. tube. .875–14 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .562–18 UNF 2B thread.	SAE J514 O-ring, .375" O.D. tube. .5625–18 UNF 2B thread.
	Metric Flange	M	ISO 6149–1 O-ring M22 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread	ISO 6149–1 O-ring M14 x 1,5 thread

Inlet Pressure, Case Pressure, and Operating Temperature Requirements

Inlet Pressure			Case Pressure			Operating Temperature	
Rated Absolute bar (psi)	**Minimum** bar, absolute (in. Hg)	**Maximum Gauge** bar (psi)	**Maximum Continuous** bar (psi)	**Maximum Intermittent** bar (psi)	**Peak** bar (psi)	**Rated** °C (°F)	**Maximum Intermittent** °C (°F)
1,0 (14.5)	0,85 (5)	3,5 (50)	0,5 (7)	2 (30)	3,5 (50)	82 (180)	104 (220)

Hydraulic Fluids

Fluid	**Recommended Operating Viscosity Range** cSt (SUS)	**Maximum Viscosity at Startup** cSt (SUS)	**Minimum Viscosity @ Max. Intermittent Temperature of 104° C (220° F)** cSt (SUS)
Use anti-wear hydraulic oil, or automotive type crankcase oil (designations SC, SD, SE, or SF) per SAE J183 FEB80	16 to 40 (80 to 180)	5000 (20,000)	9 (50)

For more information, see Vickers publication 694. For operation on other alternative or environmentally friendly fluids, please contact your Vickers representative.

Fluid Cleanliness

The PVQ pumps are rated in anti-wear petroleum fluids with a contamination level of 20/18/14 (Vickers) or ISO 18/14. Operation in fluids with levels more contaminated than this is not recommended. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these codes. Please contact your Vickers representative for specific duty cycle recommendations.

Vickers PVQ pumps, as with any variable displacement piston pumps, will operate with apparent satisfaction in fluids up to the rating specified here. Experience has shown, however, that pump and hydraulic system life is not optimized with high fluid contamination levels (high ISO cleanliness codes).

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials, and additives for protection against wear of components, elevated viscosity, and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561 – “Vickers Guide to Systemic Contamination Control” – available from your local Vickers distributor. In this publication, filtration and cleanliness levels for extending the life of axial piston pumps and other system components are listed. Included is an excellent discussion of the selection of products needed to control fluid condition.

⚠ *Warning.* Care should be taken that mechanical and hydraulic resonances are avoided in the application of the pump. Such resonances can seriously compromise the life and/or safe operation of the pump.

Drive Data

Mounting attitude can be either horizontal or vertical, using the appropriate case drain ports to ensure that the case remains full of fluid at all times. Consult your local Vickers representative if a different arrangement is required.

In those cases where geometric tolerances of mounting are critical, or where specific tolerance ranges are required and not specified, consult Vickers Engineering for specific limits.

Direction of shaft rotation, viewed from the prime mover end, must be as indicated in the model designation on the pump – either right hand (clockwise) or left hand (counterclockwise).

Direct coaxial drive through a flexible coupling is recommended. If drives imposing radial shaft loads are considered, please consult your Vickers representative.

Start-up Procedure

Make sure the reservoir and circuit are clean and free of dirt/debris prior to filling with hydraulic fluid.

Fill the reservoir with filtered oil and fill to a level sufficient enough to prevent vortexing at the suction connection to pump inlet. It is good practice to clean the system by flushing and filtering, using an external slave pump.

⚠ Before the pump is started, fill the case through the uppermost drain port with hydraulic fluid. The case drain line must be connected directly to the reservoir and must terminate below the oil level.

Once the pump is started, it should prime within a few seconds. If the pump does not prime, check to make sure that there are no restrictions between the reservoir and the inlet to the pump, that the pump is being rotated in the proper direction, and that there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet.

After the pump is primed, tighten the loose outlet connections, then operate for five to ten minutes (unloaded) to remove all trapped air from the circuit.

If the reservoir has a sight gage, make sure the fluid is clear – not milky.

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Service Parts Information

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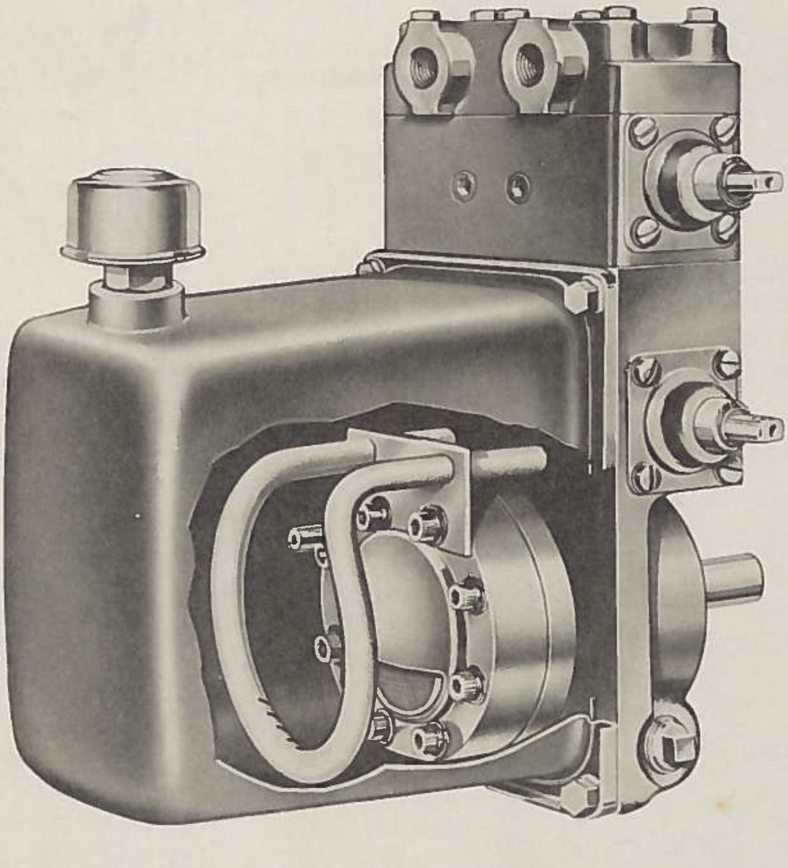
PK1-****-*-12
PK6-****-*-12
PK11-****-*-12



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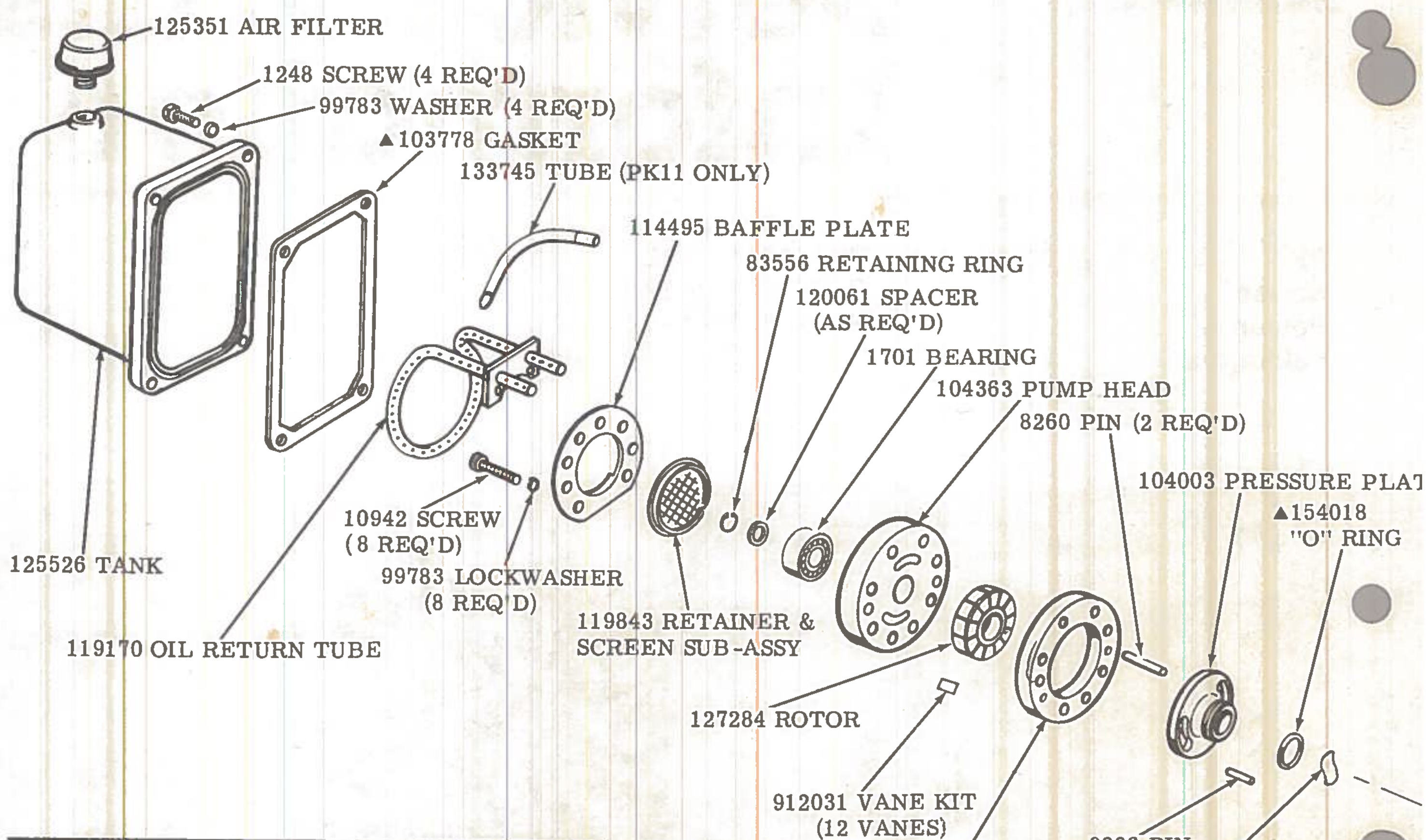
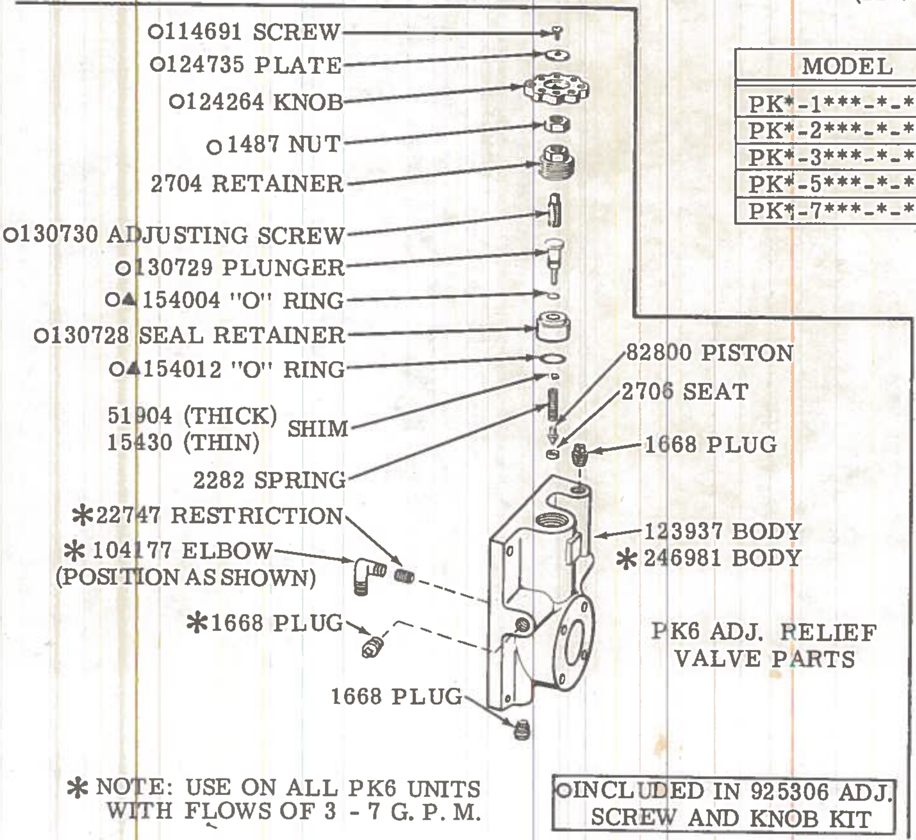


MODEL	RING
PK*-1***-*-**	120713
PK*-2***-*-**	104165
PK*-3***-*-**	104166
PK*-5***-*-**	104018
PK*-7***-*-**	109999

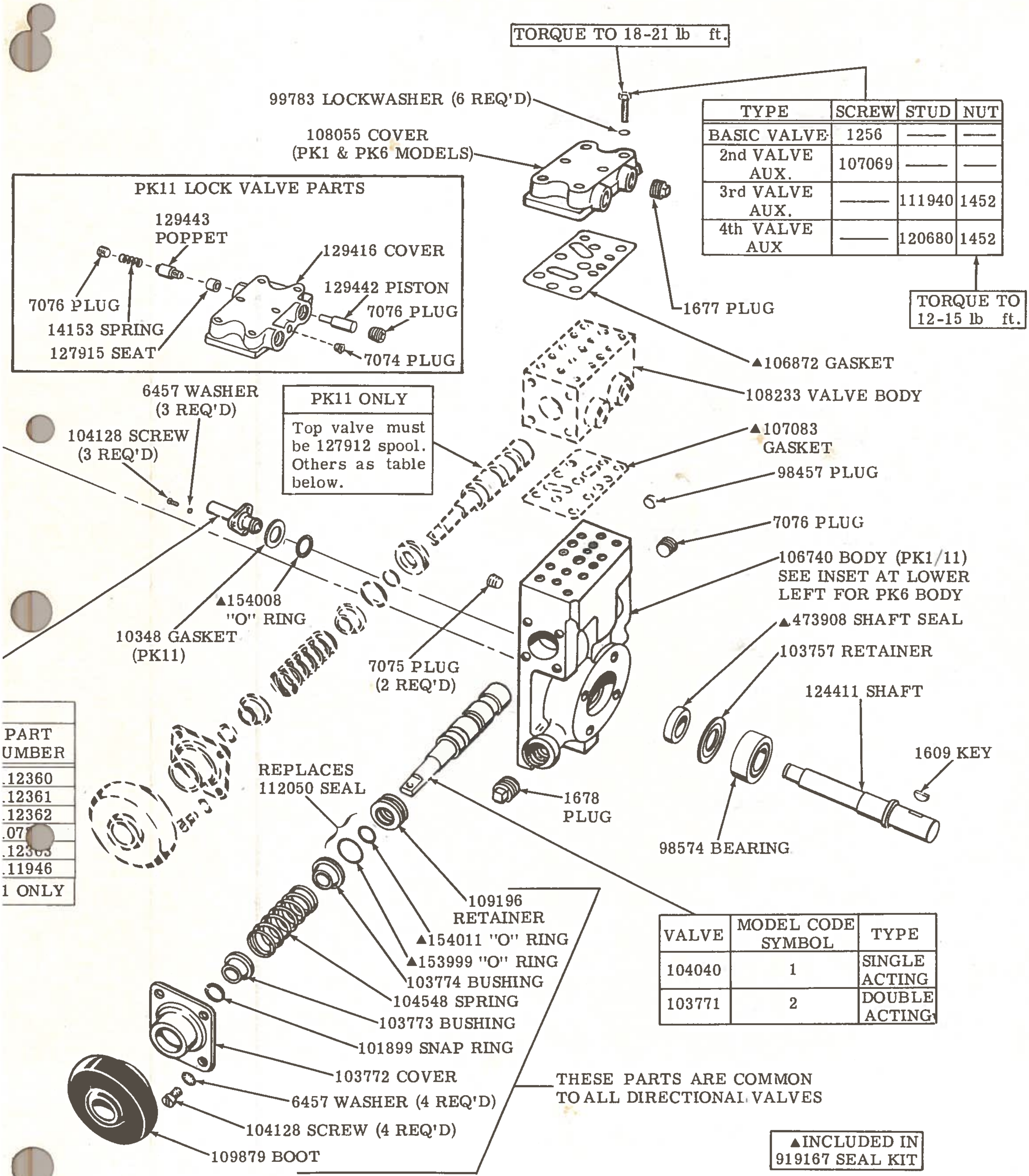
MODELS	RELIEF VA	
	SUFFIX	PRESSURE (P. S. I.)
ALL	A	250
	B	500
	C	750
	D	1[illegible]
PK*-2000	E	1250
PK*-5000	F	1500
RELIEF VALVE USED ON PK1		



PK6 ADJ. RELIEF
VALVE PARTS

✻NOTE: USE ON ALL PK6 UNITS
WITH FLOWS OF 3 - 7 G. P. M.

oINCLUDED IN 925306 ADJ.
SCREW AND KNOB KIT



TYPE	SCREW	STUD	NUT
BASIC VALVE	1256	——	——
2nd VALVE AUX.	107069	——	——
3rd VALVE AUX.	——	111940	1452
4th VALVE AUX	——	120680	1452

PK11 ONLY

Top valve must be 127912 spool. Others as table below.

PART UMBER
.12360
.12361
.12362
.07
.123
.11946
1 ONLY

VALVE	MODEL CODE SYMBOL	TYPE
104040	1	SINGLE ACTING
103771	2	DOUBLE ACTING

▲INCLUDED IN 919167 SEAL KIT

MODEL CODE BREAKDOWN

PK * – * * * * * – * – 1 2 (L)

1 2 3 4 5 6 7 8 9 10 11

1 Power Pack

2 Series

1 – Long Tank
6 – ADJ. Relief Valve
11 – Lock Valve In Cover

3 Nominal Pump Capacity

4 Basic Valve

0 – None
1 – Single Acting
2 – Double Acting

5 Second Valve

0 – None
1 – Single Acting
2 – Double Acting

6 Third Valve

0 – None
1 – Single Acting
2 – Double Acting

7 Fourth Valve

0 – None
1 – Single Acting
2 – Double Acting

8 Relief Valve

(Working Pressure)

9 Design

10 Modification

11 Rotation

(Optional)

L – Left Hand (CCW Rotation)

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 18/15 or cleaner. Selections from OFP, OFR, and OFRS filter series are reecommended.

Litho in U.S.A.

+ L208

VICKERS®
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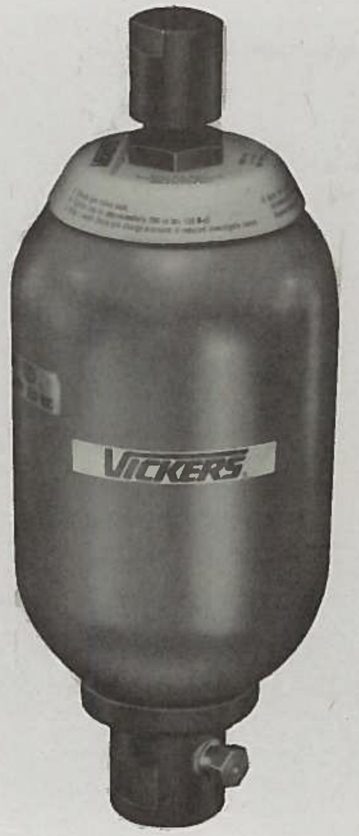
Service Parts Information

Bladder Type Accumulators

(F3) A1-75-30
(F3) A1-200-30
(F3) A1-550-30
(F3) A1-1050-30
(F3) A1-2050-30



Vickers, Incorporated

1401 Crooks Road
Troy, Michigan 48084

Revised 8-1-88 I-3986-S

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SECTION I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual provides operating instructions and overhaul information for Vickers -30 design bladder type accumulators. Information contained herein pertains to the latest design series as listed in Table 1.

Model	Assembly No.
A1-75-30	633100
A1-200-30	633101
A1-550-30	633102
A1-1050-30	633103
A1-2050-30	633104

Table 1. Model Series

B. RELATED PUBLICATIONS

Service part information is included in this manual. Installation and performance specifications are not covered in this manual. Overall dimensions and performance data are shown on installation drawing 521801. The installation drawing is available from any Vickers sales engineering office or from:

Vickers, Incorporated
Technical Publications
1401 Crooks Road
Troy, Michigan 48084

C. MODEL CODE

Variations within each model series are described in the model code. The model code is stamped on the accumulator nameplate. See Table 2.

F3	A1 –	* * * *			-30
Seals for Mineral Oil and Fire Resistant Fluids	Accumulator Bladder Type	Nominal Size	(Gas Capacity - in.^{3})	(Fluid Capacity - Gal.)	Design
		75	61	¼	
		200	213.6	1	
		550	579.7	2.5	
		1050	1067.9	5	
		2050	2044.2	10	

Table 2. Model Code

Section II – DESCRIPTION

A. GENERAL DESCRIPTION

Vickers industrial type accumulators are made of seamless steel alloy that is shaped into a cylindrical form having spherical ends. Each accumulator contains a Buna type rubber bladder. The bladder is precharged through the valve core with nitrogen gas. The opposite end of the accumulator contains an oil valve which connects into the hydraulic circuit. The oil valve has an SAE straight thread connection. The bladder is protected from wear at the oil valve end by a rubber sealing ring. This sealing ring helps prevent scuffing of the bladder during operation. The shell interior has a 500 micro finish that increases bladder life. Figure 1 is a typical cross sectional view of a -30 design bladder type accumulator.

B. OPERATION

Operation of the accumulator is automatic. A combination of oil, which is virtually non-compressible, and nitrogen, which can both expand and compress, make the accumulator work. As oil is pumped into the accumulator, it forces the gas to compress until resistance of the gas equals the oil pressure. When the hydraulic system needs oil, the compressed gas forces oil from the accumulator to maintain system flow.

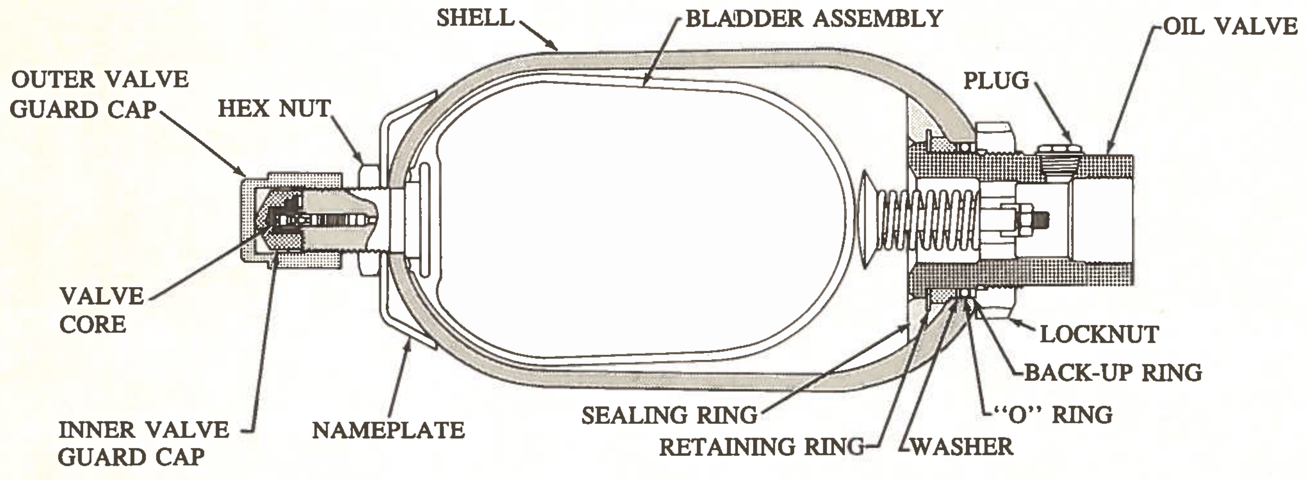


Figure 1. Sectional View

Section III – INSTALLATION & MAINTENANCE

A. INSTALLATION

All Vickers accumulators have female connections. If it is necessary to adapt to smaller fittings, forged steel reducer bushings should be used. Vertical mounting of the accumulator is recommended, but horizontal mounting is permissible. A1-75-30 and A1-200-30 accumulators may be mounted in a line unsupported, providing the line can support the charged accumulator and is free from excessive vibration. Supports should be provided whenever possible. Large size accumulators *must* be supported.

NOTE

Before an accumulator is installed in a hydraulic circuit, it should be inspected, supplied with lubrication oil, and precharged with nitrogen gas. Refer to Section IV for the accumulator precharge procedure.

CAUTION

NEVER USE OXYGEN GAS IN AN ACCUMULATOR.

NOTE

When the accumulator is installed in a hydraulic circuit, make sure the accumulator lock nuts and the bleeder plug are tight.

B. PLACING ACCUMULATOR IN SERVICE

After a hydraulic circuit has been opened by alterations to the circuit, the circuit should be purged of air. This is accomplished by purging the circuit at its highest point while intermittently operating its components. If purging is desired in the area of the accumulator, it may be accomplished through the optional bleeder plug located on the side of the oil valve. A ¼ NPTF plug is standard.

CAUTION

DO NOT REMOVE THE BLEEDER PLUG (4) FROM THE ACCUMULATOR. Caution must be used when loosening the bleeder plug, as the oil is under high pressure. Use the bleeder plug to remove extrained air from the accumulator portion of the circuit.

C. PRODUCT LIFE

The service life of this product is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

Section IV – PRECHARGING PROCEDURE

Precharge the accumulator with nitrogen gas as follows:

1. Remove the outer and inner valve guard cap from the gas valve.

2. Attach a charging hose assembly directly from the nitrogen bottle to the accumulator. Turn the 'T' bar handle inward to depress the valve core of the bladder. See Figure 2 for charging hose connections. Refer to Table 3 for the appropriate accumulator charging and gauge assemblies.

Model	Ass'y.	Nomenclature
ACGH-0-L-10	579309	No gauge - L.H. female thd.
ACGH-1500-L-10	179442	1500 PSI liquid filled gauge, L.H. female thd.
ACGH-3000-L-10	179443	3000 PSI liquid filled gauge, L.H. female thd.
ACGH-O-R-10	579310	No gauge - R.H. male thd.
ACGH-1500-R-10	579311	1500 PSI liquid filled gauge, R.H. male thd.
ACGH-3000-R-10	579312	3000 PSI liquid filled gauge, R.H. male thd.

Table 3. Accumulator Charging & Gauging Assemblies

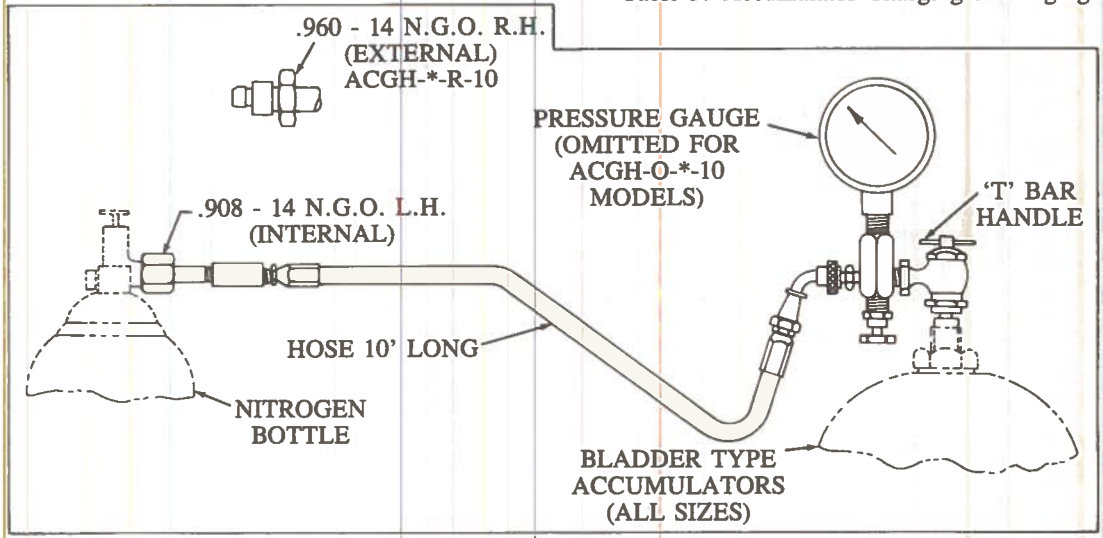


Figure 2. Accumulator Charging & Gauging Device.

3. Open the valve on the nitrogen bottle slowly allowing nitrogen to flow to the accumulator. Intermittently close the valve to allow the accumulator gauge to settle. Precharge pressure will vary with each application, but must not be less than one quarter (¼) or preferably one third (⅓) of the maximum working pressure.

If an accumulator is to be used for absorbing pump pulsations or line shocks, it should be precharged to 60 percent of the mean line pressure and installed as near the source of shock as possible.

4. When the required pressure is reached, maintain for two minutes then read the gauge again. As the nitrogen equalizes in the accumulator, a slight pressure drop will be observed. Slowly open the charging valve again and bring pressure up to the desired reading.

5. Close valve on the nitrogen bottle securely. Turn the "T" bar handle at the accumulator outward to release the valve core, then remove the charging hose assembly.

6. Carefully test accumulator gas connection for leakage by pouring system fluid in and around the valve core area. Tighten any loose connections. If the core leaks, depress and release the core rapidly to reseat the valve core. No leakage can be tolerated in this area. Replace the core if leakage cannot be stopped.

7. Install a shut-off valve between the accumulator oil port and the main line. Action of the accumulator on the hydraulic circuit can be stopped by means of this valve. Another shut-off valve should be installed between the accumulator and the reservoir. These valves provide a means of isolating and draining the accumulator in the event that servicing is required.

8. Install the accumulator in an accessible location for ease of maintenance.

9. Install a check valve between the pump and accumulator to prevent pump reversal. Other valves may be installed between the check valve and the pump for unloading after maximum circuit pressure is attained.

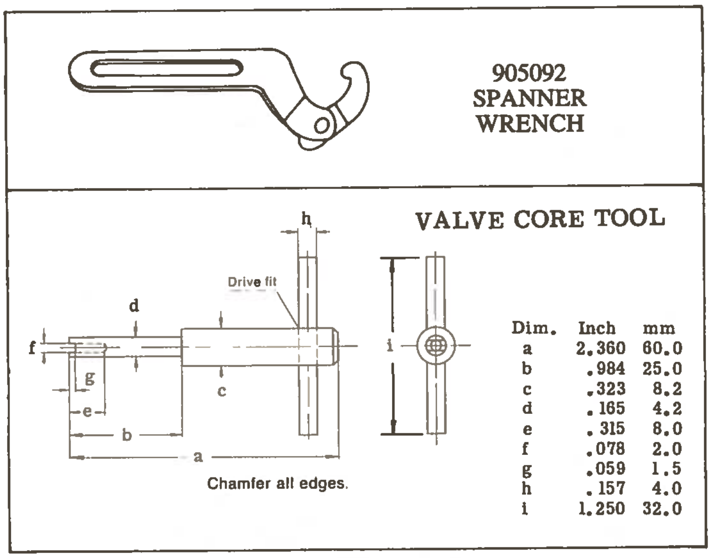
10. *DO NOT* weld supports to the accumulator shell.

Section V – OVERHAUL

A. SERVICE TOOLS

The following list of service tools are required to overhaul a Vickers bladder type accumulator. Special service tools are shown in Figure 3.

1. 10″ adjustable wrench
2. A small, thin blade screwdriver
3. A medium size screwdriver
4. Compressed air
5. Cleaning solvent (methylated spirits or water)
6. Soap solution with brush applicator
7. Heavy duty vise with padded jaws (use on smaller accumulators)
8. Chain vise (use on larger accumulators)
9. A clean, sturdy work bench
10. Spanner wrench (see Figure 3)
11. Valve core tool (see Figure 3)
12. Clean, system fluid
13. Safety glasses
14. A medium size funnel
15. Nitrogen gas
16. Accumulator charging devise (see Figure 2 and Table 3)
17. Flashlight



Dim.	Inch	mm
a	2.360	60.0
b	.984	25.0
c	.323	8.2
d	.165	4.2
e	.315	8.0
f	.078	2.0
g	.059	1.5
h	.157	4.0
i	1.250	32.0

Figure 3. Special Service Tools

B. TROUBLESHOOTING GUIDE

CAUTION

Make sure the accumulator is not subject to hydraulic pressure before removing it from the circuit.

The following chart (Table 4) provides types of accumulator problems, probable causes, and repair solutions. In most cases, accumulator overhaul requires the replacement of the bladder and anti-extrusion ring assembly. Note that improper operating conditions may cause accumulator failure. If this is the case, make sure that the operating conditions are corrected before placing the accumulator into service.

TYPE OF PROBLEM	PROBABLE CAUSE	REPAIR SOLUTION
External Leakage:		
1. Gas valve leaks.	Damaged or broken gas valve core.	Replace valve core or bladder.
2. Gas valve leaks.	Loose connection at accumulator gas valve.	Tighten connection.
3. Oil valve leaks.	Damaged or missing seals.	Replace with new anti-extrusion ring kit.
4. Oil valve leaks.	Loose connection, damaged threads, improper oil valve function.	Tighten connection or replace oil valve.
Internal Leakage:		
1. Bladder leaks at vulcanized seam.	Foreign material introduced into bladder Manufacturing or material fault.	Replace bladder. Check system for cleanliness.
2. Bladder is charred, brittle, or porous.	Working pressure ratio too high causing excessive nitrogen and oil temperature.	Replace bladder. Check working pressure parameters.
3. Cracks at center portion of bladder.	Material fatigue.	Replace bladder.
4. Hole in bladder.	Damaged at assembly, or charge pressure too low causing hole in bladder.	Replace bladder. Check accumulator charge pressure.

Table 4. Troubleshooting Guide

C. DISASSEMBLY

Disassemble the accumulator by item sequence number as shown in Figure 4. Place accumulator parts on a clean surface for inspection.

CAUTION

WEAR SAFETY GLASSES TO PREVENT POSSIBLE EYE INJURY.

1. For smaller size accumulators, clamp the oil valve (10) portion of the accumulator in a heavy duty vise. Protect the oil valve by inserting two flat pieces of steel between the oil valve and the vise jaws. For larger size accumulators, secure the accumulator in a chain vise.

2. Remove outer and inner valve guard cap (1 & 2) to expose core (3).

3. Press on valve core (3) to release gas from the accumulator bladder.

4. Remove valve core (3) with the valve core tool shown in Figure 3.

5. Loosen hex nut (11).

6. Remove slotted nut (4) with a spanner wrench.

7. Remove accumulator from vise and secure on a clean, sturdy work bench.

8. Remove and discard back-up ring (5), o-ring (6), and washer (7) from oil valve (10). Use a thin bladed screwdriver.

9. Push oil valve (10) into accumulator shell (14) until retaining ring (8) and sealing ring (9) are exposed.

10. Reach into shell and align the two flat surfaces of retaining ring (8) with shell opening. Remove retaining ring from shell.

11. Reach into shell and remove sealing ring (9) from shell. Bend or compress the sealing ring to facilitate removal.

12. Remove oil valve (10) from shell (14).

13. Remove hex nut (11) and nameplate (12).

14. Reach into shell opening and remove bladder (13). Slightly fold and twist the bladder for easier removal. If the bladder is very slippery, hold onto bladder with a clean rag.

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c. Install bias piston spring (33) and bias piston (32) over bias piston rod (34).

d. Install control piston spring (37) and control piston rod (36) within control piston (38).

e. Install valve plate pin (31) into valve block (27). Install valve plate (30) over the valve plate pin. (Use grease on the back side of valve plate to prevent separation from valve block during installation.) Make sure valve plate is flush against the valve block. Lubricate face of the valve plate with system fluid and then lubricate cylinder block (47).

CAUTION

In the following step *do not* allow valve plate (30) to touch cylinder block (47) and then back away. Valve plate (30) may adhere to the cylinder block and if pulled away, can fall out of position with valve plate pin (31). If valve block (27) is then moved against housing (80), damage to valve plate and cylinder block may result.

f. Install gasket (28) over the two alignment studs. Position valve block (27) on alignment studs and slide up against housing (80). Make sure shaft (60) is aligned with bearing and does not hit against the valve plate during installation. Thread screws (25 & 26) through valve block and into housing (80). Remove alignment studs and replace them with the appropriate screws. Tighten valve block screws to value noted in Table 9.

12. Install a new shaft key (59) into the end of shaft (60). Turn piston pump from the vertical position and set it on the workbench with shaft in the horizontal position.

NOTE

At this time, turn the pump shaft in both directions with a wrench. There should be a slight breakaway torque and the shaft should turn free in both directions. If there is resistance to turning in either direction, investigate.

NOTE

The following steps 13 and 14 will vary with different control arrangements. Perform these steps as required for your control. Refer to control parts drawing M-2231-S.

13. Assemble "O" rings (24) on plugs (23) and thread plugs into valve block (27). Torque plugs to 15-18.4 lb. ft. (20-25 N.m).

14. Assemble items (22 through 19) on sleeve (16). Assemble all shims (18) over sleeve. Lubricate seals with system fluid and insert sleeve (16) into valve block (27). Insert feedback spool (17) into sleeve (16), with short land pointing out of valve block. Refer to Figure 10. Install a new "O" ring (15) on plug (14). Lubricate and thread plug (14) into valve block over sleeve (16). Tighten plug (14) to the value noted in Table 11. Final adjustment of feedback spool shims will be accomplished during test.

MODEL	PLUG TORQUE	
	N.m	lb. ft.
PVD45	244 - 257.6	180 - 190
PVD80	300 - 330	221 - 243
PVD120	130 - 140	96 - 103

Table 11. Feedback Spool Plug Torque

15. Assemble the charge relief valve parts as follows:

a. Lubricate and install spring (12) into piston (13). Slide piston and spring into valve block (27).

b. Assemble "O" ring (7) on plug (6). Assemble spring (8) into plug (6). Assemble shims (9) over poppet (10). Insert poppet into spring, located in plug (6). Thread seat (11) into plug (6). Tighten seat (11) into plug to the values noted in Table 12.

MODEL	SEAT TORQUE	
	N.m	lb. ft.
PVD45	14 - 18	10 - 13
PVD80	12 - 15	8.85 - 11
PVD120	31 - 37	23 - 27

Table 12. Charge Relief Valve Seat Torque

c. Install plug (6) into valve block (27). Make sure spring guide portion of seat is located within spring (12) at assembly. Torque plug (6) into valve block (27). The torque figures are the same as for the feedback spool plug shown in Table 11.

16. Assemble the charge pump to the piston pump as follows:

a. Clean the charge pump pad located on the valve block. Make sure the area of contact is clean.

b. Install coupling (5) over end of piston pump shaft (60).

c. Install charge pump assembly and seal (4) to the valve block (27). Install screws (3) and tighten to value noted in Table 13.

MODEL	SCREW TORQUES	
	N.m	lb. ft.
PVD45	46 - 48	34 - 35.4
PVD80	180 - 200	132.8 - 147.5
PVD120	160 - 172	118 - 127

Table 13. Charge Pump Screw Torque

17. Assemble control (2) to valve block (27) with screws (1). Be sure to assemble various control sections in the order of removal. Make sure control seals are in place before installation. Install control tubing in place. To check orientation of control, refer to control parts drawing M-2231-S.

Section VII – TEST PROCEDURE

NOTE

Due to the nature of the PVD heavy duty piston series, the use of a hydraulic pump control is mandatory. Refer to controls drawing and overhaul manual M-2231-S for appropriate control parts and testing of PVD piston units with controls.

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P O BOX

9. Obtain a spacer kit and perform the shaft end play shimming procedure (steps 'a' through 'l').

a. Select the thinnest spacer (29a) from the spacer kit and install it on end of shaft.

b. Install tail bearing cones (29) on end of shaft against spacer (29a).

c. Install gasket (28) onto pump housing (80).

d. Install valve block (27) on housing. Secure the valve block with screws (26). Tighten the screws to value noted in Table 9.

MODEL	VALVE BLOCK SCREW TORQUES	
	N.m	lb. ft.
PVD45	47.5 - 54.2	35 - 40
PVD80	180 - 200	133 - 147.5
PVD120	251 - 278	185 - 205

Table 9. Valve Block Screw Torque

e. Position the unit so that the shaft (60) is in a vertical position.

f. Rotate the shaft by hand and lift up and down on the shaft to seat the bearings.

g. Place a dial indicator at end of shaft and measure shaft movement. Repeat this step two times to obtain an average reading.

h. Remove the valve block (27), tail bearing cone (29) and spacer (29a).

i. Select the proper spacer thickness from spacer kit to obtain .001-.004 shaft end play.

j. Install spacer (29a) on end of shaft.

k. Repeat steps 'b' through 'g'. Perform steps 'h' through 'j', if required, until .001-.004 shaft end play is obtained.

l. Remove valve block (27), gasket (28), bearing cone (29) and spacer (29a). Set these parts aside.

10. Assemble rotating group as follows:

NOTE

If cylinder block (47) was disassembled during inspection, install washer (51), spring (50), washer (49) and retaining ring (48). Refer to Figure 11 and reverse removal procedures. *Make sure* that sharp edge of retaining ring (48) points outward and is seated properly within its groove before removing threaded tool from cylinder block.

a. Set cylinder block (47) on a clean surface. Use Kraft paper between cylinder block face and work bench to prevent scratching the machined surface. Lubricate cylinder block bores with system fluid.

NOTE

In the following step, make sure lock spacer (44) is positioned properly for insertion of lock key (43). The lock key fits into the off center slot of the lock spacer. If in doubt, insert lock spacer into yoke (78) without rotating group to verify correct orientation.

b. Place lock spacer (44) on top of cylinder block (47) then install nine piston and shoe subassemblies (46) with shoe plate (45) into the cylinder block. See Figure 10. Piston shoe subassemblies and shoe plates differ between the PVD45 and the PVD80/120 units. The PVD45 uses a scalloped shoe plate and the PVD80/120 uses a full round hole type shoe plate. The PVD45 scalloped shoe plate assembles into a groove located in the side of each shoe. The PVD80/120 shoe plate assembles behind the shoes (between shoe and cylinder block).

NOTE

The rotating group should be installed in the horizontal plane.

c. Install the complete rotating group over the shaft end and slide the group forward until the shoes rest against swash plate (67) located within yoke (78). Rotate slightly to align spline of shaft to cylinder block.

d. Use special tool (a length of 1/8" drill rod) to position lock spacer (44) into yoke (78). Turn lock spacer with tool until its slot is in line with key (43). Insert key (43). Verify that key is located within the slot. This is very important. If the key is not positioned properly, destruction of the pump may result at start-up. (NOTE: PVD45 units have an additional pin lock (42) and roll pin (79) arrangement. Install pin lock (42) over key (43). Then install roll pin (79)). Install pintle cover (41) and screws (40). Tighten screws to value noted in Table 5.

e. Install spacer (29a) in place on the shaft. Then install bearing cone (29) on the shaft.

11. Assemble valve block (27) to housing as follows:

NOTE

If bias piston rod (34) and control piston (38) were removed from valve block (27), perform the following steps 'a' and 'b'. If the parts were not removed from valve block (27), omit the following two steps and perform step 'c'.

a. Install a new "O" ring (35) on bias piston rod (34). Thread the bias piston rod into valve block (27) and torque to value noted in Table 10.

MODEL	TORQUE	
	N.m	lb. ft.
PVD45	203	150
PVD80	240 - 260	177 - 192
PVD120	300 - 350	221 - 258

Table 10. Piston Rod Torque

b. Install a new "O" ring (39) on control piston (38). Thread the control piston into valve block (27) and torque to value noted in Table 10.

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g. Place the housing mounting surface on a suitable workbench. See Figure 13.

h. Push the yoke up and down two or three times by hand.

i. Place a force indicator at highest yoke ball location. See Figure 13. Apply force to the yoke ball and observe the force required to start yoke movement. The force required to move the yoke is noted in Table 6. If the force is too high, the shim (76) thickness must be reduced. If the force is too low, the shim (76) thickness must increase. (NOTE: One pound of force equals approximately .001 shim thickness.)

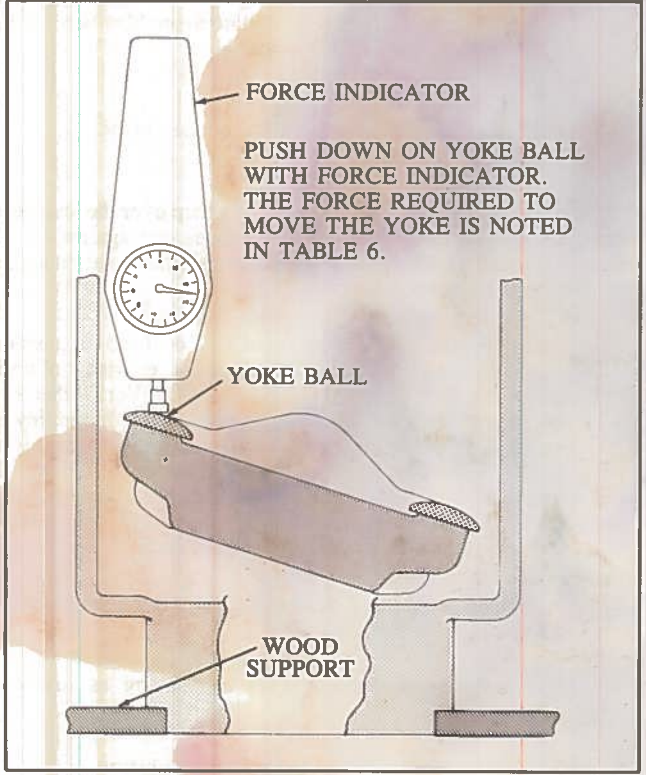
FORCE INDICATOR
PUSH DOWN ON YOKE BALL WITH FORCE INDICATOR. THE FORCE REQUIRED TO MOVE THE YOKE IS NOTED IN TABLE 6.
YOKE BALL
WOOD SUPPORT

Figure 13. Force Measurement

MODEL	FORCE	
	Newtons (N)	Pounds (lb.)
PVD45	44.5 - 66.75	10 - 15
PVD80		
PVD120		

Table 6. Force Required To Move Yoke

j. Repeat steps 'h' and 'i' if necessary. Adjust shim (76) thickness to Table 6.

k. Remove pintle cover (41) so that pin hole in yoke hub is exposed.

2. Install swash plate pin (68) into yoke (78) and assemble swash plate (67) in place over the pin. Check height of pin in yoke and depth of hole in swash plate. There should be clearance to allow swash plate to set flat against yoke surface. Make sure swash plate pin hole is aligned properly with the pin before assembly.

3. Install "O" rings (66 & 64) over plugs (65 & 63 Lubricate and thread plugs into housing (80). Tighten plugs the value noted in Table 7.

MODEL	PLUG TORQUE	
	N.m	lb. ft.
PVD45	140 - 150	103 - 111
PVD80	129 - 142	95 - 105
PVD120	170 - 190	125 - 140

Table 7. Housing Plug Torques

NOTE

Perform the following step if bearing (62) was removed from shaft (60) during inspection. Omit the following step if bearing was not removed from the shaft.

4. Install retaining ring (61) in place on shaft (60).

a. Press bearing (62) on shaft (60). Make sure small end of cone points toward end of shaft at completion of press. Use an arbor press for this operation.

b. Clean bearing with a solvent compatible with system fluid. Lubricate and set bearing race in place over the cone.

c. Rotate the bearing race and cone to verify freedom of movement and smooth operation. Bearing must not bind or have a feeling of roughness.

NOTE

If bearing race (29) was removed from valve block (27), press a new bearing race in place as noted in the following step. If the bearing race is in place within the valve block, omit the following step.

5. Position valve block (27) on the clean surface of an arbor press. Use a piece of wood to protect lower surface of valve block. Position new bearing race (29) with small I.D. facing into valve block. Press in place. Use a suitable socket wrench or piece of hardwood as a pressing tool. Press bearing race (29) into valve block until it bottoms against shoulder.

6. Install shaft (60) with bearing into flange end of housing (80).

7. Install "O" rings (55) and retaining rings (58) (if removed). Install appropriate shaft seals (56 & 57). Single shaft seal units will use seal (57) only. The spring loaded member of seal (56) is pointing out of the pump. The spring loaded member of seal (57) points into the pump. Lubricate shaft seals and "O" rings with system fluid and install inner seal retainer (54) in place within the pump. Use a layer of plastic tape over shaft splines to prevent cutting the seals.

8. Install the outer seal retainer (53). Thread screws (52) through outer seal retainer (53) and into housing (80). Cross tighten the screws to value indicated in Table 8.

MODEL	TORQUE SCREWS TO:	
	N.m	lb. ft.
PVD45	7 - 9	5.1 - 6.6
PVD80	20 - 25	14.8 - 18.4
PVD120	11 - 13	8.1 - 17.0

Table 8. Torque Retainer Screws (52) As Indicated

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8. Inspect feedback spool (17) for scratches on exterior of the lands. If scratches are found, replace spool (17) and sleeve (16) as a subassembly. The spool and sleeve are critical parts and cannot be replaced individually. Feedback spool subassemblies are tabulated on the control parts drawing. See Table 2.

9. Inspect bearings (29, 62, 71 & 77) for brinelling, pitting of rollers and roughness when turned in the bearing race. If a bearing is defective, both the bearing cone and bearing race must be replaced. If bearing race located in valve block (27) requires removal, refer to the procedure shown in Figure 12.

10. Inspect the bronze surface of valve plate (30) for excessive wear, scoring, or heavy erosion. If any of these conditions are noted, replace the valve plate. In most cases, the bronze surface will have a slight circular wear pattern and brown, burnishing areas. This is normal. The overall condition of the valve plate is attributed to the amount of service life, system fluid conditions and actual operating conditions of the pump.

11. Inspect bias piston (32) and bias rod (34) for proper fit. Make sure the parts fit together without binding. Also, make sure the end of bias piston (32) is not worn at the area of yoke (78) contact. If wear is found, check yoke (79) ball socket for bind. The yoke ball should rotate freely a total of 17.5° spherical without binding.

12. Inspect control piston (36) and sleeve (38) as noted in previous step.

13. If yoke (78) was removed from housing (80), check for wear at the area of the yoke pintles (yoke bearing area). Check yoke for stress cracks. Replace yoke if wear or cracks are found. If yoke is replaced on a PVD45 unit, install a new roll pin (79) into the yoke pintle.

14. Inspect pintle cover(s) (41) and (73) if removed. Check for flatness and burrs. Remove burrs with an India stone.

15. Inspect lock spacer key (43) for wear. Replace if worn or deformed.

16. Inspect lock spacer (44) for excessive wear, heavy scratches and burrs. Replace if the part shows evidence of wear. Remove burrs with an India stone.

17. Inspect shoe plate (45) for cracks and heavy wear. If wear is evident, replace the part. The PVD45 shoe plate is shown in Figure 10. PVD80 and 120 shoe plates differ from the one shown. PVD80 and 120 shoe plates have nine circular openings instead of the nine half circles of the PVD45 shoe plate.

18. Inspect cylinder block (47) for wear, scratches and/or erosion between cylinders. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (46) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston, lubricate with clean system fluid and try again. Even minor contamination of the fluid could cause the piston to freeze up within the cylinder block bore.

19. Check retaining ring (48), washer (49), spring (50) and washer (51) which were removed from the cylinder block for wear and burrs. Replace if defective.

20. Inspect each piston shoe subassembly (46) for a maximum end play of 0.003 inch (0.0762 mm); also, check for freedom of movement of the shoe. The shoe must be free to rotate through 17° minimum (spherical). Replace the complete set of piston/shoe subassemblies if one is defective.

21. Check retainer (53) for burrs and heavy scratches. Remove scratches and burrs with an India stone or small file.

22. Check inner seal retainer (54) for burrs, especially check "O" ring groove areas. Remove burrs with an India stone.

23. Do not remove retaining rings (58) from within seal retainer (54) unless they are bent or broken.

24. Inspect shaft key (59) for evidence of wear. Replace if worn.

25. Inspect shaft (60) for wear and chipped splines, also check for wear in the area of the shaft seal. If the shaft is worn more than 0.005 inch (0.127 mm) total indicator reading (TIR), replace the shaft. Do not remove retaining ring (60) from the shaft unless it shows evidence of wear or the shaft requires replacement.

26. Inspect swash plate (67) for wear, pickup, heavy scratches and excessive wear. Replace the swash plate if evidence of wear is shown or if piston shoe wear was noted in step F.20.

27. Inspect pin (68) and two spacers (70 & 75) for burrs. Clean up with an India stone.

28. *Do not* remove roll pin (79) from yoke (78) on PVD45 models unless damaged or the yoke is replaced.

29. Inspect housing (80) for burrs, nicks, cracks, cross threads and wear in the area of the pintle bearings. Check each pintle face for flatness and burrs. Inspect mounting face for deep scratches that could cause leakage past the gasket. Clean up burrs and small scratches with an India stone.

G. ASSEMBLY OF PISTON PUMP

1. If yoke (78), pintle bearings (71, 77) or housing (80) are replaced, obtain a new shim kit and perform the pintle bearing preload shimming procedure (steps a through k).

a. Insert the yoke (78) into housing (80) so that both yoke hubs are centered at pintle opening of housing.

b. Lubricate bearing cones (71, 77) with clean system fluid. Install the bearing cones into housing and onto yoke hubs.

c. Install matching bearing races (71, 77) into housing opening over the bearing cones. *Do not* force the bearing races into housing.

d. Position the housing (80) so that the pin hole at end of yoke hub is exposed.

e. Assemble spacer (70) on top of bearing race (71). Install "O" ring (69) into housing groove. Fasten the pintle cover (41) to housing with four screws (40). Tighten the screws to value noted in Table 5.

MODEL	TORQUE SCREWS TO:	
	N.m	lb. ft.
PVD45	14.7 - 16.9	10.8 - 12.5
PVD80	41 - 49	30.2 - 36.1
PVD120	40 - 50	29.5 - 36.9

Table 5. Pintle Cover Screw Torque

f. Reposition the housing to assemble the other pintle parts. Install approximately .025/.027 shim (76) thickness on top of bearing race (77). Install spacer (75). Install "O" ring (74) into housing groove. Assemble pintle cover (73) onto housing with four screws (72). Tighten the screws to value noted in Table 5.

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CAUTION

Spring (50) located within the cylinder block is under a high compression and can cause bodily harm if retaining ring (48) is removed without adequate caution. See Figure 11 for disassembly instructions.

13. Remove shaft key (59) from shaft (60). Remove the front shaft seal arrangement, items (52 through 58). Disassemble "O" rings (55) and shaft seals (56 & 57) from retainer (54). Discard seals and "O" rings. *Do not* remove retaining rings (58) unless they are defective. PVD45 and PVD120 units require a TX-30 Torx tool for removal of screws (52). See special tools.

14. Remove shaft (60) from housing (80). Slide shaft (60), retaining ring (61) and bearing (62) as an assembly out of the flange end of housing. *Do not* remove retaining ring and bearing from shaft unless inspection determines the parts defective.

15. Remove plugs and "O" rings (63 through 66). Discard "O" rings.

16. Remove swash plate (67) and pin (68) from yoke (78).

NOTE

In the following step, the yoke and bearings may not require removal from the housing. The top yoke bearing (71) can be removed without disturbing the yoke bearing preload adjustment. Inspection of the yoke and top yoke bearing will give an indication of the condition of these parts. If any signs of wear or cracks in the yoke are found, or if the bearing has signs of brinelling, pitting of the rollers or demonstrates roughness when turned in the race, remove both bearings and the yoke for further inspection. If the yoke is replaced, a yoke bearing preload adjustment must be performed at assembly. Each set of pintle parts must be kept separated from each other during the following inspection. Pintle bearings may show marks caused by static loading of roller and race. These marks are called "false brinelling" by the manufacturer. If rotation of the bearing within its race is smooth, the bearing is usually serviceable even though it may appear bad.

17. Remove the four screws (40) and cover (41). Remove parts (69 through 71). Inspect the bearing and yoke as noted above. If found defective, remove parts (72 through 79) from housing (80). If the bearing and yoke are found serviceable, install bearing (71), bearing spacer (70), cover (41) and screws (40) back into the housing. Thread screws (40) hand tight. Do not remove special valve block alignment screws during inspection. They will be used to assemble the unit.

F. INSPECTION, REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning valve block passages, cylinder blocks, etc.

NOTE

Shaft (60) on the PVD45 model was changed to allow easier shimming at the rear bearing on the -23 design instead of the front bearing as on the older -22 design. The new shaft can be used to repair the -22 design, if necessary, when spacer (29a) is used. Follow shimming procedure G9.

Refer to Service Drawing M-2239-S for shim kits.

1. Inspect all screws for burrs, broken or stripped threads and worn corners on the hex head. Use an India stone to clean up burrs. If threads or hex heads are defective, replace the screw.

2. Inspect coupling (5) for worn and broken splines. Replace coupling if defective.

3. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs. If threads are defective, replace the plug.

4. Inspect springs for wear and damaged coils. Replace spring if worn or damaged. Inspect springs for distortion. The ends of the spring must be parallel to each other and ground square with axis within 3°. Replace if distorted.

5. Inspect charge relief valve poppet (10) for wear. Replace if worn.

6. Inspect charge relief valve seat (11) for wear and erosion. Replace if defective.

7. Inspect the charge relief valve (13) for wear, galling, erosion and burrs. If wear is found, replace the part. Check wear by inserting the valve into the valve block bore. Move the part in and out while rotating through 360°. If the valve hangs up or binds, use an India stone on the exterior of the valve to eliminate any possibility of burrs. Check the bore of the valve block for scratches and worn areas. Replace both the valve block (27) and relief valve (13) if parts are found defective.

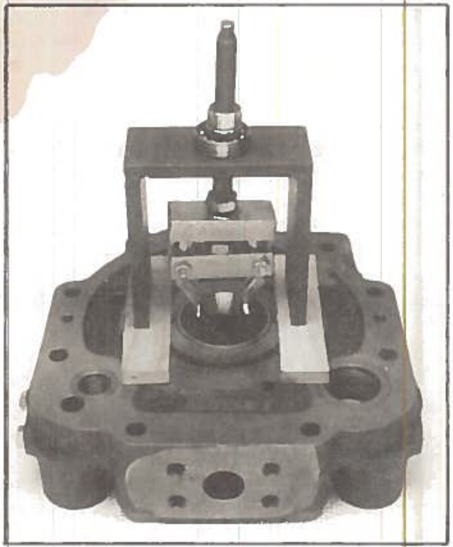

Figure 12. Removal of Bearing Race from Valve Block

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E. DISASSEMBLY OF PISTON PUMP

1. Remove charge relief valve parts, items (6 through 13). A small pencil magnet may be found useful during this operation. See Figure 10.

NOTE

Units that do not use the yoke feedback parts will omit the following steps, items (14 through 22) (See Figure 10).

2. Remove yoke feedback parts, items (14 through 22). Use care during removal of sleeve (16) to prevent scoring feedback spool (17).

3. Remove plugs (23) and "O" rings (24). Discard "O" rings.

4. Remove two valve block screws (25) located across from each other. Install the studs noted under special tools for this unit into housing (80). Tighten in place with vise grip pliers.

5. Remove the remaining valve block screws (25) and set aside for inspection.

6. Use the chain fall to help remove the valve block (27) from the housing (80). Slide the valve block away from the housing slowly. Valve plate (30) may stick to cylinder block (47) during removal of the valve block. Be careful not to damage the valve plate, valve block or housing faces during this operation. Once the valve block moves away, do not allow the valve block to move back against the housing as the valve plate may be damaged. Discard gasket (28).

NOTE

In the following step, it is sometimes difficult to remove valve plate (30) from cylinder block (47). If this is the case, remove bearing (29). This allows valve plate (30) to drop down for easy removal.

7. Remove valve plate (30). Remove rear shaft bearing cone (29) and spacer (29a) from shaft (60). Do not remove rear shaft bearing race (29) from the valve block.

8. Remove valve plate pin (31) from the valve block. Do not damage the valve block during removal.

9. Remove bias piston (32) and spring (33). Do not remove bias piston rod (34) and "O" ring (35) unless inspection of the bias rod indicates a problem.

10. Remove control piston (36) and spring (37). Do not remove control piston sleeve (38) and "O" ring (39) unless inspection of the control piston indicates a problem.

11. Remove the four screws (40) which hold the pintle cover (41) to the housing. Remove cover (41). Located under the cover on PVD45 units is a key locking arrangement, items (42 & 79). These will not exist on the PVD80 and PVD120 models. Item (43) is a key that fits in the slot of spacer (44) and retains the rotating group. After removal of the key, replace the pintle cover and screws. Tighten the pintle cover and screws. Tighten the pintle screws hand tight.

12. Reach into the housing with the special length of 1/8 inch drill rod prepared in the special tools section of this manual. Rotate lock spacer (44) with the drill rod to unlock shoe plate (45) from within yoke (78). Reach in with both hands and grab the complete rotating group as a unit and withdraw from the housing.

NOTE

The rotating group consists of the following items: spacer (44), shoe plate (45), 9 piston and shoe S/A (46), cylinder block S/A (47), retaining ring (48), washer (49), spring (50) and washer (51).

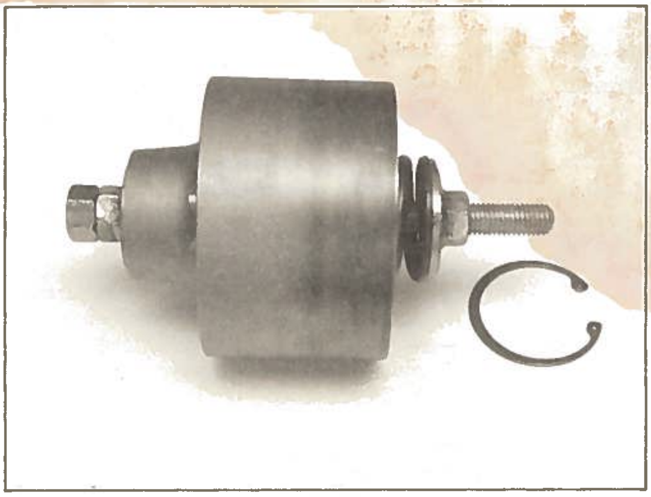

Figure 11.

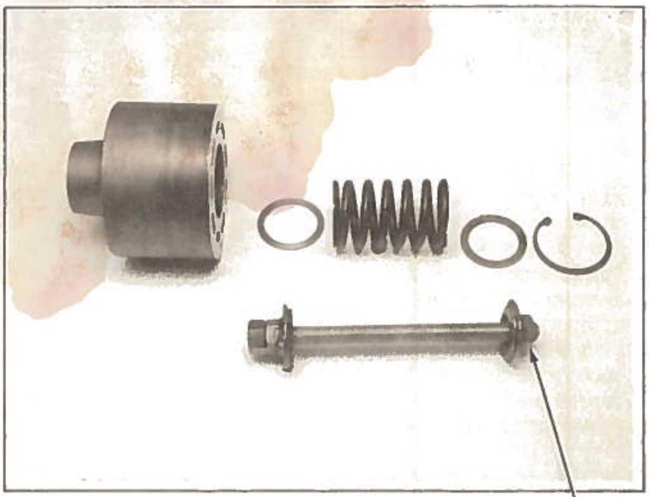

Figure 11a.

Cylinder Block Disassembly Procedure

Install tool with slotted washer toward retaining ring end of cylinder block S/A. Position slot so retaining ring can be removed. Tighten nuts to compress spring and washer. Remove retaining ring. Loosen nuts to relieve spring compression.

See Figure 7 for this tool

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ITEM	PART NUMBER	QTY.	ITEM	PART NUMBER	QTY.
1	Screw	4	41	Cover	1
2	Control	1	42	Pin Lock	1
3	Screw	4	43	Key	1
4	Charge Pump	1	44	Lock Spacer	1
5	Coupling	1	45	Shoe Plate	1
6	Plug	1	46	Piston & Shoe S/A	9
7	"O" Ring	1	47	Cylinder Block	1
8	Spring	1	48	Retaining Ring	1
9	Shims	A/R	49	Washer	1
10	Poppet	1	50	Spring	1
11	Seat	1	51	Washer	1
12	Spring	1	52	Screw	4
13	Valve	1	53	Retainer	1
14	Plug	1	54	Seal Retainer	1
15	"O" Ring	1	55	"O" Ring	2
16	Sleeve	1	56	Outer Shaft Seal	1
17	Spool	1	57	Inner Shaft Seal	1
18	Shims	A/R	58	Retaining Ring	2
19	"O" Ring	1	59	Shaft Key	1
20	Back-Up Ring	1	60	Shaft	1
21	"O" Ring	1	61	Retaining Ring	1
22	Back-Up Ring	1	62	Shaft Bearing	1
23	Plug	2	63	Plug	1
24	"O" Ring	2	64	"O" Ring	1
25	Screw	7	65	Plug	1
26	Screw	1	66	"O" Ring	1
27	Valve Block	1	67	Swash Plate	1
28	Gasket	1	68	Pin	1
29	Tail Bearing	1	69	"O" Ring	1
29a	Spacer	1	70	Spacer	1
30	Valve Plate	1	71	Bearing	1
31	Pin	2	72	Screw	4
32	Bias Piston	1	73	Cover	1
33	Spring	1	74	"O" Ring	1
34	Bias Piston Rod	1	75	Spacer	1
35	"O" Ring	1	76	Shims	A/R
36	Control Piston	1	77	Bearing	1
37	Spring	1	78	Yoke	1
38	Control Piston Sleeve	1	79	Roll Pin	1
39	"O" Ring	1	80	Housing	1
40	Screw	4			

Figure 10. Piston Pump Exploded View Part Nomenclature
(PVD45 shown)

7. Thread four screws (4) through adapter (5) into cover (11). Tighten the screws to 35-45 lb. ft. (47.2-60.8 N.m.)

8. Drive shaft must turn freely by hand after assembly. Install a new "O" ring (2) into adapter (5). Cover the unit to prevent dirt contamination.

9. Place the PVD80 or PVD120 cover (5) in the jaws of a vice with interface pointing up. Figure 9 shows the pump assembled in the right hand configuration. Reverse the location of the drive and driven gears (12 & 13) for left hand units.

10. Install the drive and driven gears (12 & 13) into charge pump cover (5). Make sure of proper shaft rotation for the unit. (See Figure 9.)

11. If the relief valve was removed, install spring (11), poppet (10) and seat (9) as shown in Figure 9. Press seat (9) in place within adapter (14). Check movement of poppet (10) after installation.

12. Install a new "O" ring (6) into the groove of cover (5).

13. Install center section (7) over the gears. Right hand units will have the inlet positioned as shown in Figure 9. Flood gears with system fluid. *Do not* pinch "O" ring (6) during installation.

14. Install "O" ring (8) into adapter (14) and lubricate journals. Orient the adapter to align pins and then install over drive and driven gears (12 & 13) and up against center section (7). Alignment pins will hold adapter (14) and center section (7) in the proper position. *Do not* pinch "O" ring (8) at assembly.

15. Thread the two retaining screws (4) through cover (5) into adapter (14) hand tight. Turn the pump over and place in the vise with the jaws connected to adapter (14). Tighten the two screws to 118-127 lb. ft. (160-172 N.m).

NOTE

Torque required to turn pump after assembly must not exceed 8.85 lb. ft. (12 N.m).

16. Install gasket (2) over alignment pins and set aside for assembly. Cover to prevent contamination from entering unit

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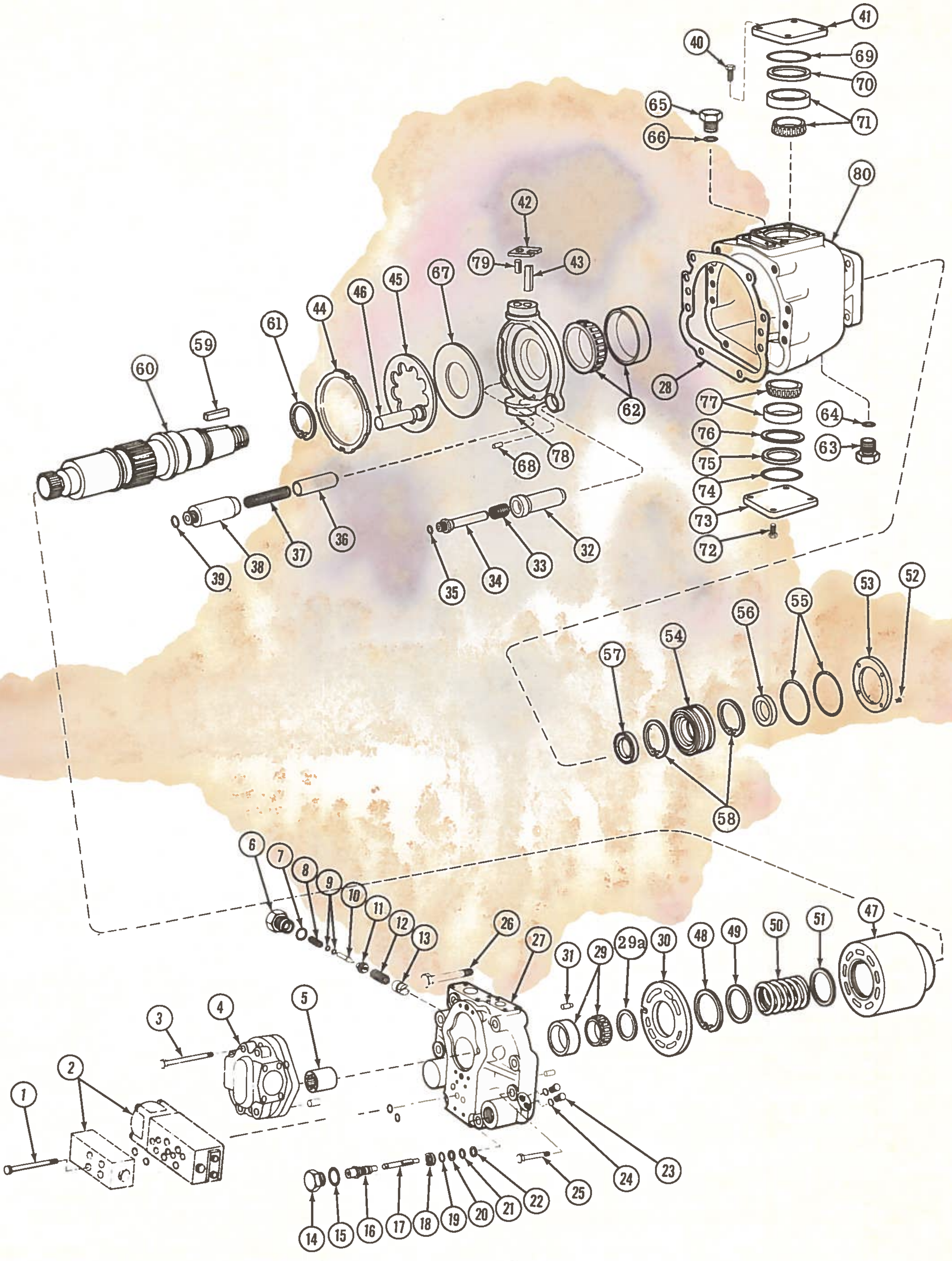

Figure 10. Piston Pump Exploded View (PVD45 shown)

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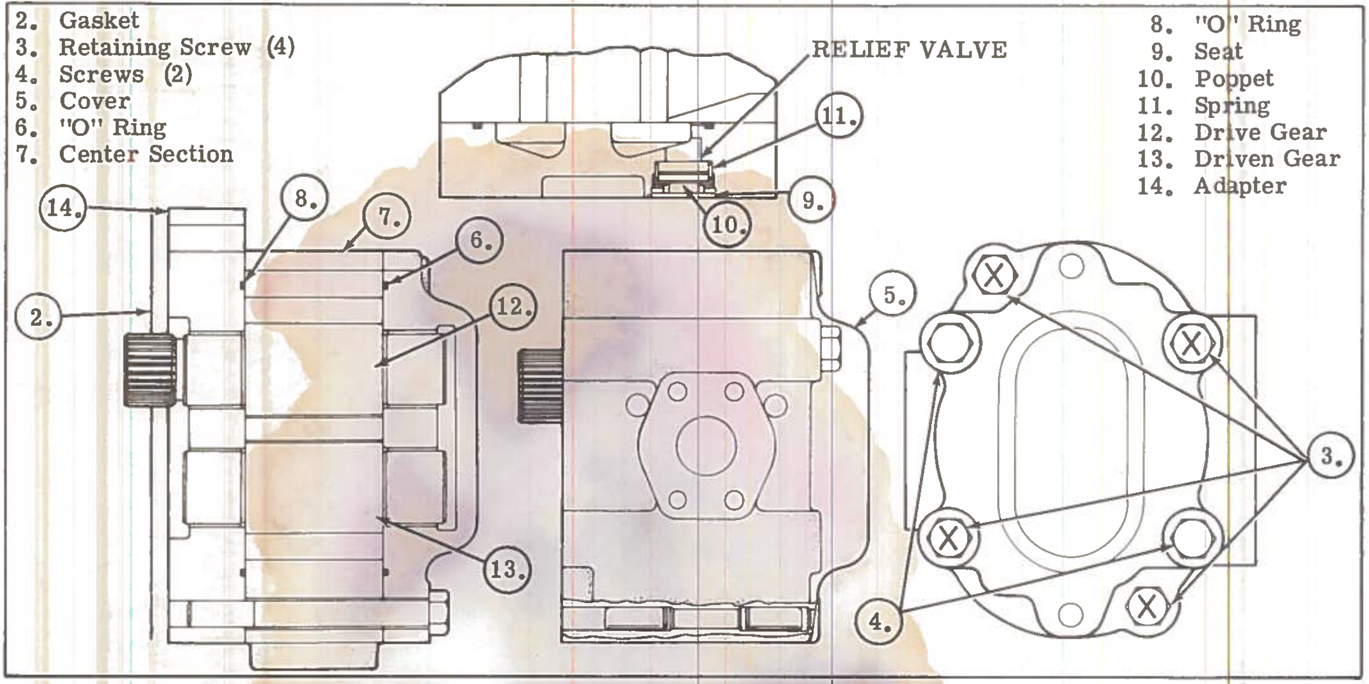

Figure 9. PVD80 and PVD120 Charge Pump

NOTE

The following steps (11) through (15) pertain to disassembly of the PVD80 and PVD120 units. Refer to Figure 9.

11. Install the charge pump into a vise with the jaws holding adapter (14) and the cover (5) pointing up.

12. Remove two retaining screws (4) from cover (5) and separate the cover from the balance of the pump. Discard "O" ring (6).

13. Remove center section (7) from adapter (14). Discard "O" ring (8). *Do not* remove relief valve seat (9) from adapter (14) unless inspection reveals a possible malfunction. Use a small tool to move poppet (10) against spring (11). The poppet should return to the seated position upon release of the tool.

14. Remove drive gear (12) and driven gear (13) from adapter (14).

15. Clean and set parts aside for inspection.

C. INSPECTION, REPAIR AND REPLACEMENT

NOTE

Replace the charge pump if parts do not meet the following specifications.

1. Inspect all components for wear, erosion and/or seizure.

2. Check the center section or cover for porosity, erosion, or heavy wear pattern.

3. Check the shaft splines and gear tips for wear or damage.

4. Check journals for burnishing and heat discoloration.

5. Check cover and adapter for excessive wear in the area of the gears.

D. ASSEMBLY OF CHARGE PUMP

NOTE

Cover the assembly area with clean Kraft paper to prevent contamination of parts.

1. Obtain a seal kit for the unit being repaired. Refer to parts drawing for seal kit information. See Table 2.

2. Assemble the charge pump as follows: Refer to sectional view Figure 8 for PVD45 units and Figure 9 for the PVD80 and PVD120 units.

NOTE

Flood all parts with clean system fluid at assembly. Perform steps (9) through (16) for PVD120 units.

3. Place cover (11) in the jaws of a vise with pocket pointing up. Figure 8 shows the pump assembled in the right hand configuration. Reverse the location of the drive and driven gears (9 and 10) for left hand rotation.

4. Install drive and driven gears (9 and 10) into charge pump cover (11). Make sure gears are located to provide proper shaft rotation for the unit.

5. Lubricate relief valve spring (8) and poppet (7) with system fluid. Assemble spring in place within cover (11) and place poppet on top of spring.

6. Lubricate journals in adapter (5). Install a new internal "O" ring (6). Orient adapter (5) to align pins and relief valve hole with cover (11). Push relief valve down into cover. Insert a cover screw through adapter hole and hold the poppet in position until adapter is in place. *Do not* pinch "O" ring (6). Check movement of poppet with screw after adapter (5) is in place.

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B. REMOVAL OF CONTROL AND CHARGE PUMP

CAUTION
Use a chain fall to handle the weight of the pump and valve block in the following steps. Thread appropriate eyebolts into the housing and valve block.

1. Set the piston pump on a steel work bench that will support the weight of the unit to be repaired.

2. Insert the chain fall hook into the valve block eyebolt and take up slack. *Do not* lift the pump from the workbench.

3. Remove existing control tubing, then, remove the four control attaching screws (1). Remove control (2) and set aside. Discard interface "O" rings. (Refer to Figure 10.)

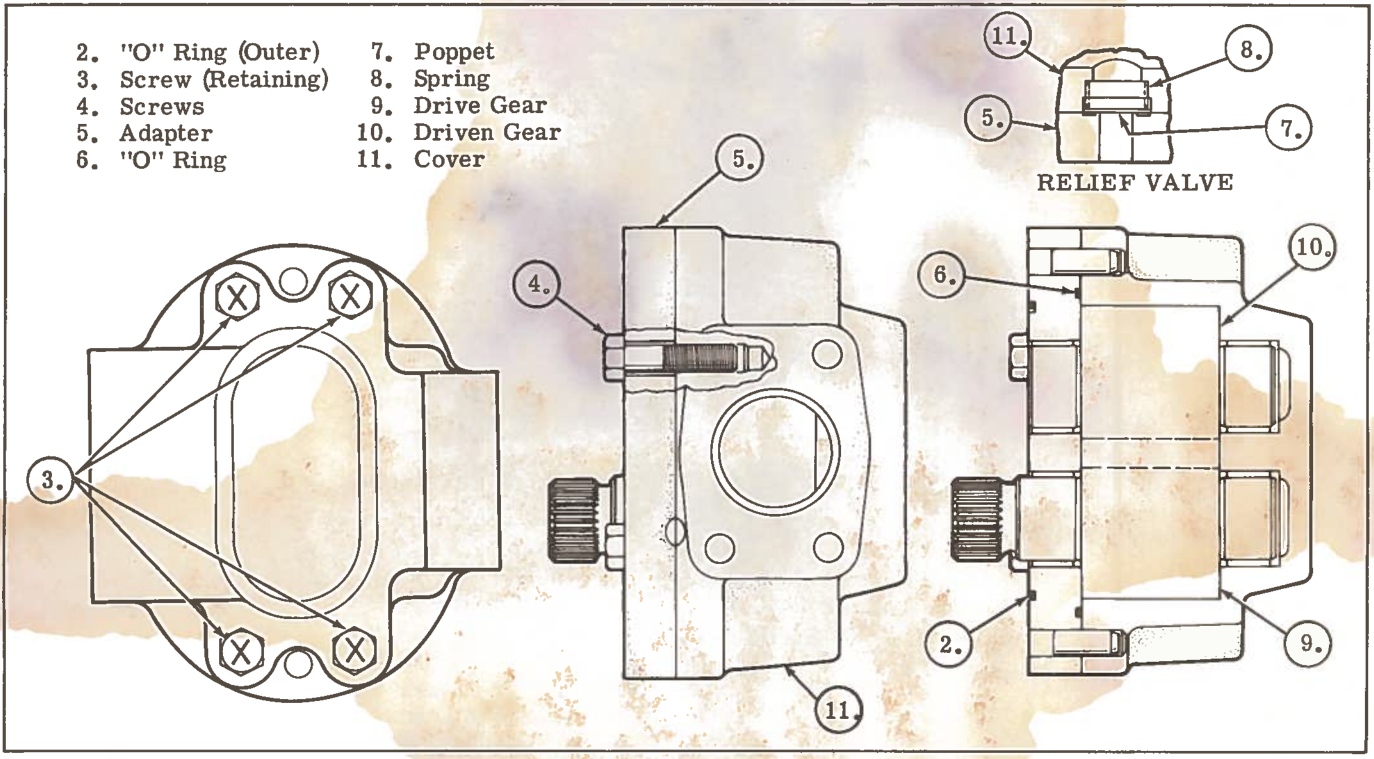

Figure 8. PVD45 Charge Pump

NOTE
This manual does not cover repair of controls. Refer to parts drawing and overhaul manual M-2231-S for this information.

NOTE
Do not disassemble the charge pump except to clean or replace seals. If other problems exist within the pump, replacement of the complete unit is recommended. If the gear pump is opened for cleaning, replace the seals.

4. Remove four retaining screws (3) located in charge pump cover. See Figure 8 for PVD45 units and Figure 9 for PVD80 and PVD120 units. Remove screws indicated by an "X".

5. Slide the charge pump away from the valve block. Discard the outer "O" ring (2) on PVD45 units. Discard the gasket (2) on PVD80 and PVD120 units. The spline coupling (5) (Figure 10) may or may not be removed with the charge pump. Remove spline coupling (5) from the shaft.

NOTE
If further disassembly of the PVD45 charge pump is required, perform steps (6 through 10). If further disassembly of the PVD80 or PVD120 charge pump is necessary, omit steps (6 through 10) and perform steps (11 through 15). If disassembly of the charge pump is not required, omit steps (6 through 15) and proceed to Section VI-E.

6. Place the charge pump in a vise. Use thin plywood shims between the vise and pump to prevent scratching machined surfaces. The spine shaft should point up.

7. Remove four screws (4) that connect adapter (5) to cover (11) on the PVD45 unit, and remove adapter (5) from cover (11) exposing the gears. Discard "O" ring (6).

8. Remove the internal relief valve poppet (7) and spring (8) from their location beneath adapter (5).

NOTE
The poppet (7), spring (8) and seat (part of adapter (5)) form an internal relief valve (5-15 PSIG). The function of this valve is to pressurize the housing, while providing an internal drain path from the housing to the inlet of the charge pump.

9. Remove the drive gear (9) and driven gear (10) from the cover pocket.

10. Clean all gear pump parts and set aside for inspection.

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TROUBLE	PROBABLE CAUSE	REMEDY
I. Excessive noise in pump.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended fluid. *Do not* over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	1. Check inlet (suction) lines and fittings for air leaks. 2. Check charge pump.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Overload protection improperly set.	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair.
IV. Loss of fluid.	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating sections of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Misadjusted or broken pump control.	Locate and repair. See parts drawing M-2231-S for control information.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 2. Troubleshooting Chart

Section VI – OVERHAUL

A. GENERAL

CAUTION

Block vehicle if it is on a slope to prevent uncontrolled movement.

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure.

Drain oil from the vehicle hydraulic system. Use new clean oil when restoring the unit to service.

Before breaking a circuit connection, hose off or otherwise clean the outside of the unit thoroughly to prevent entry of dirt into the system.

After removing the PVD pump from the vehicle and before disassembly, cap or plug all ports and disconnected hydraulic lines.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Repair of the PVD pump will generally not require disassembly to the extent described here. The sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figures 8, 9 and 10. Special procedures are included in the following steps.

NOTE

Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning the valve poppet and valve block passages.

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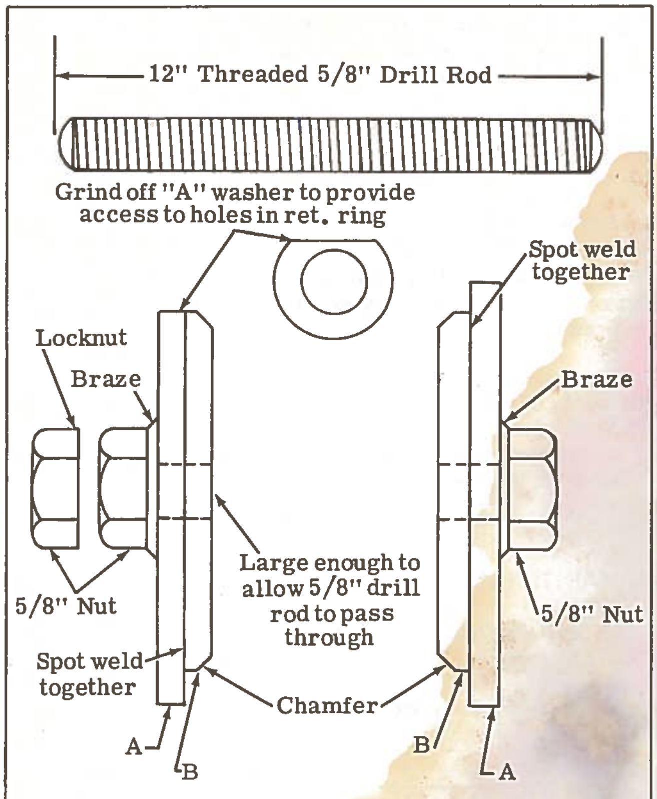
12" Threaded 5/8" Drill Rod
Grind off "A" washer to provide access to holes in ret. ring
Spot weld together
Locknut
Braze
Braze
Large enough to allow 5/8" drill rod to pass through
5/8" Nut
5/8" Nut
Spot weld together
Chamfer
A
B
B
A

MODEL	WASHER DIA.	
	A	B
PVD45	2"	1-3/4"
PVD80	2-1/2"	2"
PVD120	2-3/4"	2-1/4"

Figure 7. Cylinder Block Spring Decompression Tool

NOTE

In addition to the above tools, an arbor press is required to service bearings, etc. A chain fall is required to handle the pump and valve block assembly. Repair of this unit is intricate and should not be attempted without the proper tools.

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result.

In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. See Table 4.

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a clean fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. PRODUCT LIFE

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

H. TROUBLESHOOTING

Table 4 lists the common difficulties experienced with pumps and hydraulic systems. It indicates probable causes and remedies for each of the troubles listed.

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1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Overload protection is required to limit pressure in the system to a prescribed maximum and protect components from excessive pressure.

Experience has shown that on many mobile systems, the PVD series pressure compensator system limits pressure between the pump and directional controls to an acceptable level.

Due to varying system characteristics, it is highly recommended that relief valves be installed in the system.

G. START-UP

With a minimum drive speed of 800 RPM, a pump should prime almost immediately, if provision is made to initially purge the air from the system.

Failure to prime within a reasonable time may result in damage due to lack of lubrication. The pump housing must be filled with fluid and inlet lines must be tight and free from air leaks. It may be necessary to loosen a fitting on the outlet side of the pump to purge air trapped in the system.

Section V – SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following standard tools for overhauling the piston unit are shown in Figure 5.

1. Torque wrench with short extension and sockets
2. 1″ micrometer
3. 1″ depth micrometer
4. Internal Truarc pliers (2300)
5. External Truarc pliers (0200)

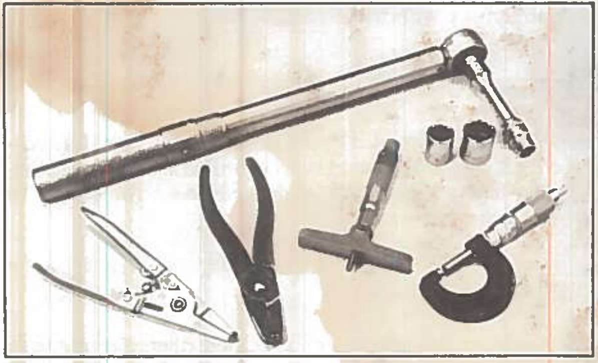


Figure 5. Service Tools

Special Tools

The following special tools are required to service the PVD heavy duty piston pump series.

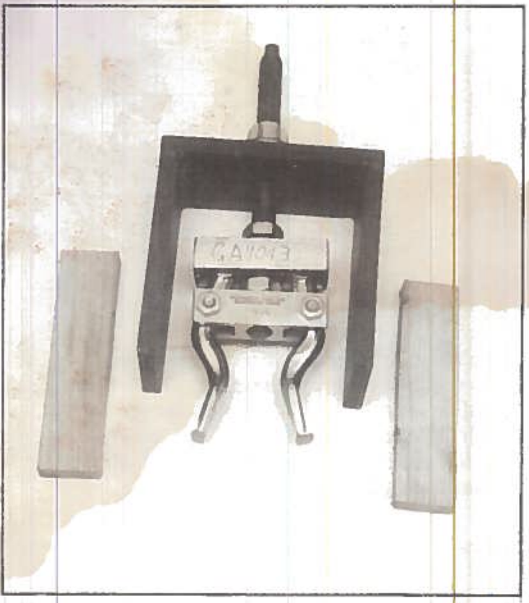
1. Obtain two long screws (tabulated in Table 3). Cut off the heads of the screws to make studs. These studs will be used to assemble and disassemble the valve block.

MODEL	SCREW (2 Req'd.)	DIA. THD.	SAE COARSE
PVD45	214689	0.437-14	CL-2A
PVD80	214776	0.625-11	
PVD120	46671	0.625-11	

Table 3. Special Screws

2. One length of 1/8 inch drill rod approximately 18 inches (457.2mm) long.

3. Valve block bearing race removal tool and shims. (See Figure 6.)



Tool #MD956
This tool is manufactured by:
Owatanna Tool Company
376 North Street
Owatanna, WI 55060

Figure 6. Bearing Race Removal Tool

4. A Torx type TX-30 insert bit is required for removal of outer seal retainer screws on the PVD45 and PVD120 units. The PVD80 uses standard hex head screws.

5. Dial indicator and accessories.

6. Cylinder block disassembly tool. See Figure 7.

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Section IV – INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawing listed in Table 2 will shown operating characteristics, installation dimensions and port locations.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawing. See Table 2.

1. Direct Mounting – A pilot on the pump mounting flange (Figure 4) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without engineering approval.

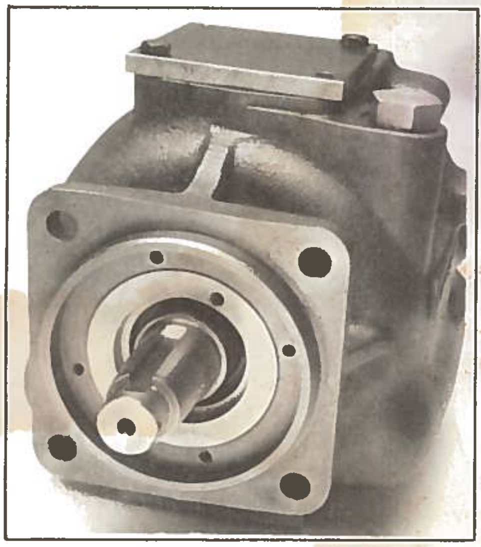

Figure 4. Pump Mounting Flange

C. SHAFT ROTATION

Pumps are assembled for both right-hand (clockwise) and left-hand (counterclockwise) shaft rotation as viewed from the shaft end.

CAUTION

Never drive a pump in the wrong direction of rotation. Seizure will result, necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with clean solvent to remove loose particles.

NOTE

For information on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube. In high pressure systems (5000 PSI), steel elbows should be used instead of bending tubing; this provides an increase in circuit life.

E. HYDRAULIC FLUID RECOMMENDATIONS

General Data

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Refer to Data sheet M-2950-S for oil selection.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended oils or operating conditions, contact your sales engineering representative.

Cleanliness

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc. cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

Sound Level

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

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Load Sensing Control

This control provides a POWER MATCH™ between the pump and load, thereby maximizing system efficiency and improving metering characteristics of the system's directional control valve.

The control senses pump outlet pressure and load pressure, and keeps the difference between these two pressures constant. The differential pressure is measured across a metering land in the system's flow control valve, with the effect that pump flow is determined by valve spool position and is independent of load pressure.

The load pressure signal is generated downstream of the flow control valve metering land, and communicated to the pump's load sensor by a signal line. In a multiple-spool load sensing valve arrangement, the internal logic must sense all load pressures and feed the highest pressure back to the pump control.

C. APPLICATION

Pump deliveries shown in the model code are in USGPM, at 1800 RPM. For flows at other speeds, methods of installation and other application information, sales engineering personnel should be consulted.

Section III – PRINCIPLES OF OPERATION

A. PISTON PUMP

The drive shaft causes the cylinder block, pistons and shoe plate to rotate within the pump. See Figure 2. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted valve plate. As the pistons move out of the cylinder block, fluid is forced into the void by charge pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

B. CHARGE PUMP

An external gear pump (Figure 3) consists essentially of two meshed gears in a closely fitted housing with inlet and outlet ports opposite each other. One gear is driven by the power source and in turning, drives the other. As the gear teeth separate and travel past the inlet, a partial vacuum is formed. Oil is forced into the inlet by atmospheric pressure and carried to the outlet in pumping chambers formed between the gear teeth and housing. As the gear teeth mesh at the outlet, oil is forced out of the pumping chambers into the outlet port. This oil is used to charge the piston pump inlet.

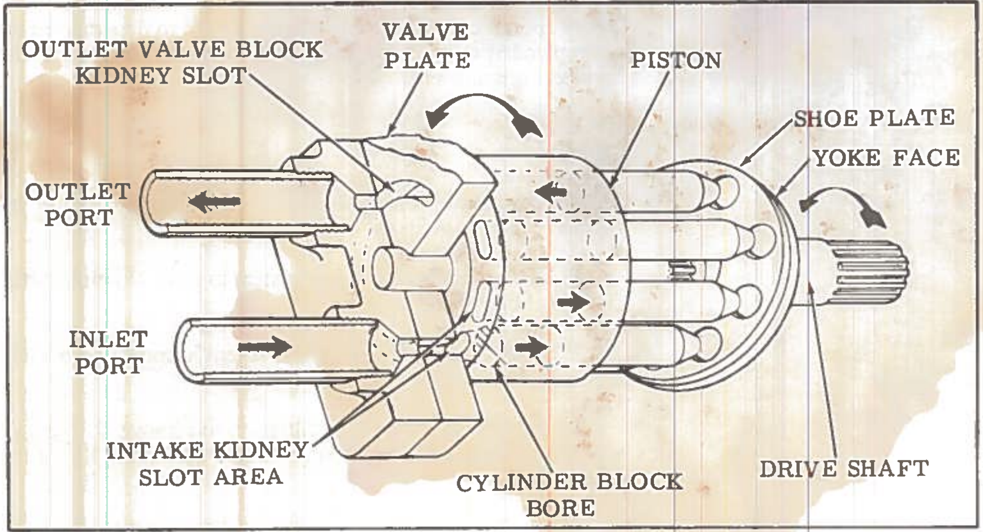

Figure 2. Piston Pump Operation

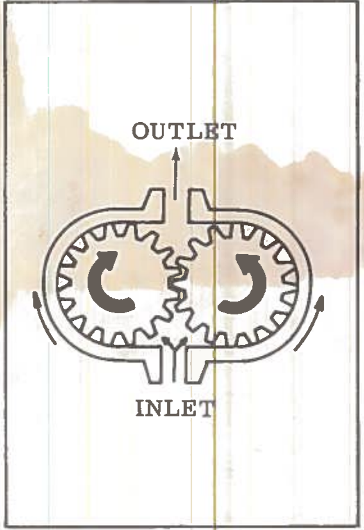

Figure 3. Charge Pump Operation

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Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes the basic operating characteristics and provides service and overhaul information for the PVD series basic pump. Piston pump controls are covered in a separate manual. The information contained herein pertains to the latest design series as listed in Table 1.

B. GENERAL INFORMATION

1. Related Publications – Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 2 are available from any sales engineering office.

2. Model Codes – Variations within each basic model series are covered in the model code. Table 1 is a partial breakdown of the codes covering these units. The basic model and assembly number will be stamped into the nameplate (i.e. PVD45-123456). Service inquiries should always include the unit model code number as stamped on the nameplate.

MODEL	PARTS DWGS.	INSTALLATION DWG.
PVD45	M-2227-S	MB-202
PVD80	M-2228-S	
PVD120	M-2229-S	
Controls	M-2231-S	

Table 2.

Section II – DESCRIPTION

A. GENERAL

Assembly of a typical PVD series piston pump is shown in Figure 1. In general, a piston pump and charge gear pump are connected in tandem on the same shaft. The gear pump provides charge flow to the piston pump inlet. A charge relief valve determines piston pump inlet pressure.

B. CONTROLS

Various controls are available with the PVD series pumps. These controls are covered by a separate service drawing and manual. See Table 1. The following is a brief description of each control:

Standard Pressure Compensator

This control limits system pressure to a desired level and is a standard feature on all pumps. When system pressure reaches the compensator setting, pump displacement starts to decrease to match the load requirements.

The compensator is sensitive to the rate of pressure rise in the system and minimizes pressure overshoot. In a highly responsive system, the pump will begin de-stroking before system pressure reaches the compensator setting. As a result, system shocks which shorten component life and cause leakage are greatly reduced, and in many cases eliminated.

Dual-Pressure Compensator

This control allows a pump to alternately operate between two pressure settings. For example, an excavator may require cylinder pressures limited to 4000 PSIG, but need 5000 PSIG for the propel motors to provide adequate tractive effort. This is easily achieved with a dual-pressure compensator.

Compensator With Remote Pressure Setting

This pressure compensator offers advantages when it is difficult or inconvenient for the vehicle operator to reach the operating pump and adjust the pressure setting. The adjustment for the compensator can be mounted in the vehicle cab or control station where movement of a knob allows the operator to achieve variable control of the compensator setting.

Torque Summation

On vehicles where one engine is driving two pumps, this control assures that pump demands do not exceed available engine torque. The control allows full engine power to be absorbed by either pump but limits the sum of the pump input torques to a level which will prevent engine stall.

Torque Limiter

This control allows maximum performance to be obtained from the vehicle engine. It limits torque at the pump input shaft to prevent engine stall while the pressure compensator limits maximum pressure in the system. When pump input speed remains constant, the torque limiter acts as an input horsepower limiter.

Speed Sensing Control

This control maintains zero displacement of the pump during startup to provide easier engine starting. Also, the control will cause the pump to return to zero displacement if a load causes the engine RPM to decrease below a certain preset level. The speed sensing control is used in place of the torque limit control. The intent of both is to keep the engine from stalling. As load begins to exceed the engine horsepower, engine speed will drop. This is sensed by the control and pump displacement is reduced.

An option provided is a by-pass circuit which permits operation at reduced engine throttle settings.

SUNNY ENTERPRISES
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MODEL CODE BREAKDOWN

(AS STAMPED INTO NAMEPLATE OF UNIT)

PVD***-******

PUMP

VARIABLE DELIVERY

INLINE SERIES D

FLOW RATING IN USGPM
(AT 1800 RPM)
45 - 45 USGPM
80 - 80 USGPM
120 - 120 USGPM

UNIT ASSEMBLY NUMBER

NOTE
A CROSS REFERENCE BETWEEN UNIT MODEL CODE AND ASSEMBLY NUMBER IS INCLUDED IN CONTROL DRAWING M-2231-S.

Table 1.

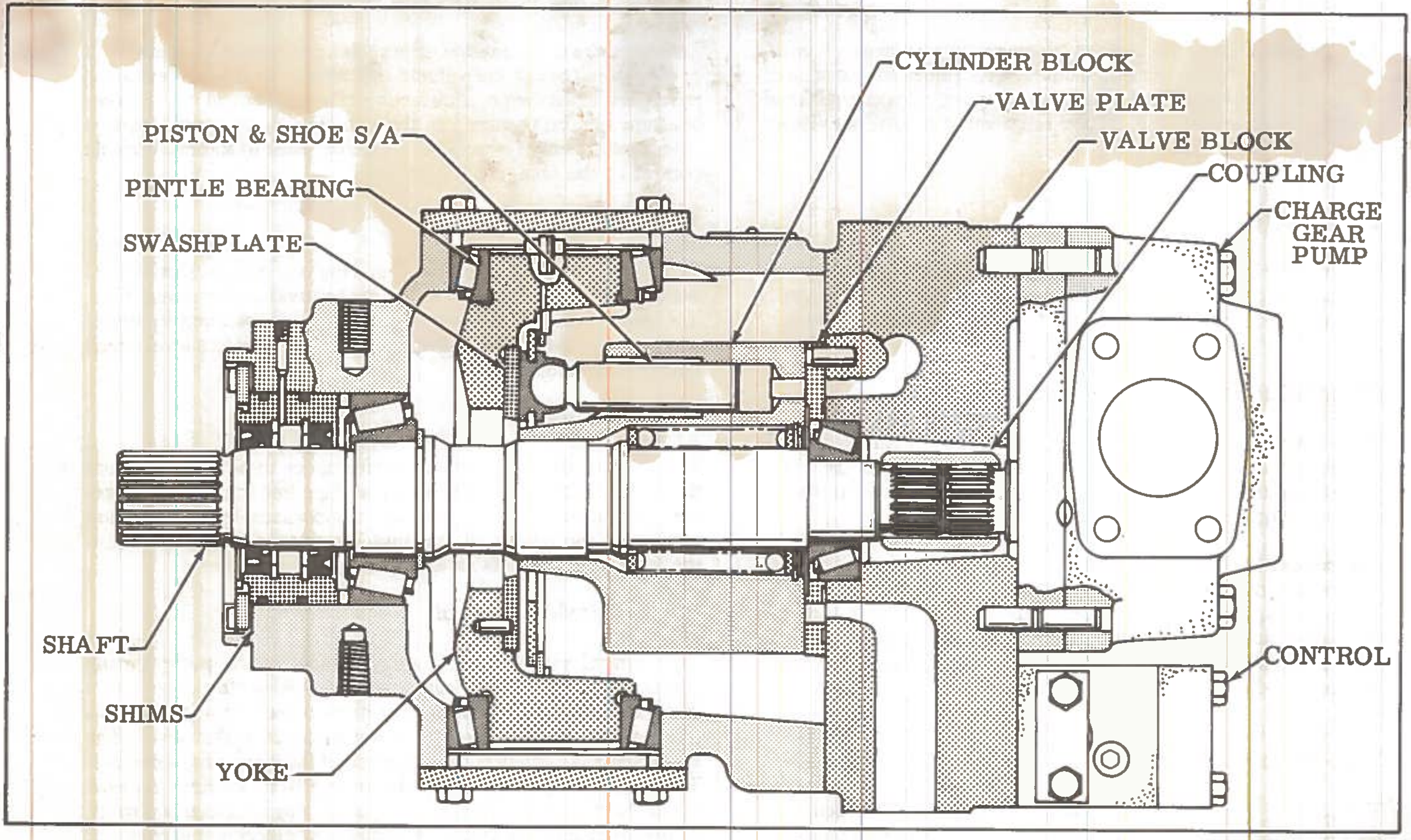

Figure 1. Typical PVD Piston Pump

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P. O. BOX 15527 KARACHI-4

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4

VICKERS®
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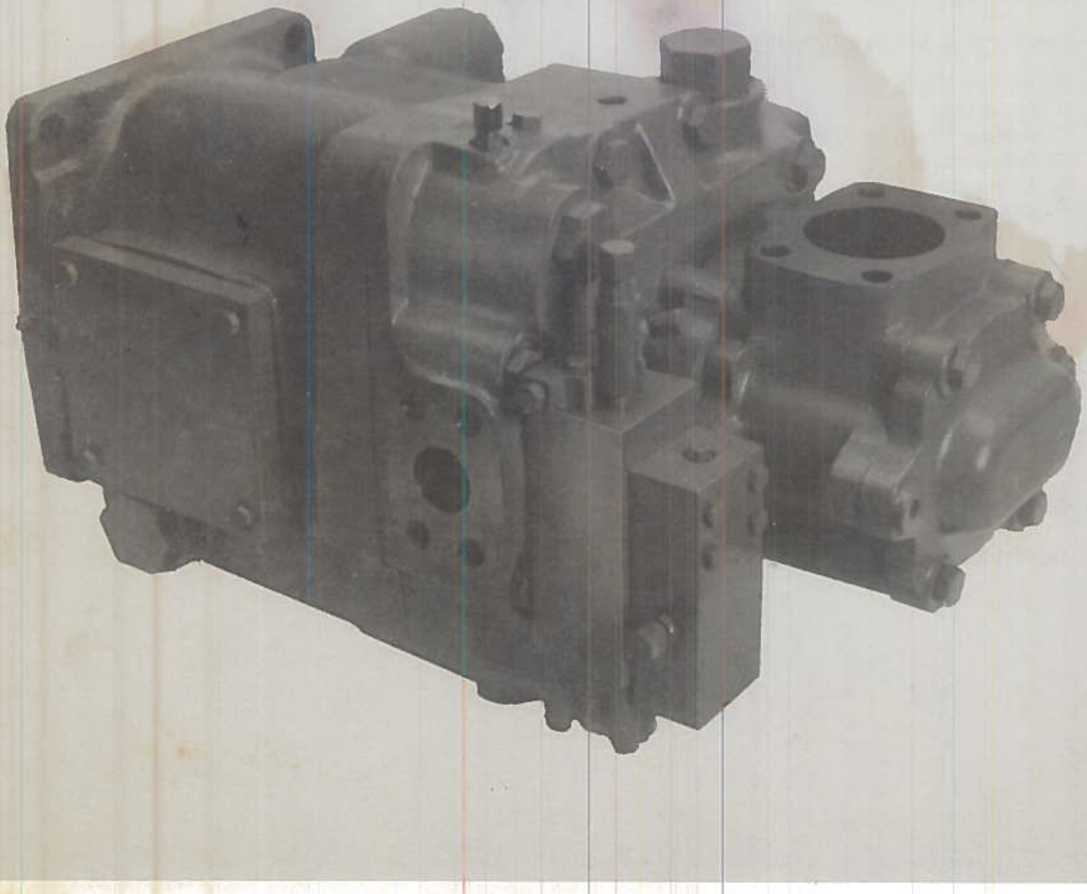
Overhaul Manual

POWER MATCH™
High Pressure
Piston Pumps

PVD45,
PVD80 &
PVD120

TECHNICAL
DATA

(66)



Vickers, Incorporated

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Revised 1-1-89

M-2230-S

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Litho in U. S. A.

PUMP MODEL	RATED SPEED (RPM)	FLOW @ 28 bar (400 PSI)	MAX. FLOW LOSS @ 250 bar (3625 PSI)
PVE27	2400	130 - 144 1/m (34.3 - 38.0 GPM)	12 1/m (3.2 GPM)
PVE27QI	1800	95.8 - 10.9 1/m (25.3 - 29.3 GPM)	12 1/m (3.2 GPM)
PVE35	2200	154.1 - 171.0 1/min (40.7 - 45.2 GPM)	13 1/m (3.4 GPM)
PVE35Q	2100	145 - 160 1/m (38 - 42 GPM)	13 1/m (3.4 GPM)
PVE35QI	1800	126.1 - 139.2 1/m (33.3 - 36.8 GPM)	13 1/m (3.4 GPM)
PVE47	2100	196 - 216 1/m (51.8 - 57.1 GPM)	17.5 1/m (4.6 GPM)
PVE47QI	1800	167.5 - 186.4 1/m (44.2 - 49.2 GPM)	17.5 1/m (4.6 GPM)
PVE 62	2000	249 - 275 1/m (65.8 - 72.6 GPM)	22 1/m (5.8 GPM)
PVE62QI	1500	187 - 207 1/m (49.4 - 54.7 GPM)	22 1/m (5.8 GPM)

Table 6. Flow Specifications

2. Increase the outlet pressure to 150 bar (2175 PSIG). Hold this condition for one minute. Reduce the outlet pressure to 28 bar (400 PSIG) and observe the pump flow from flowmeter "F". Pump flow must meet the requirement as stated in Table 6 when the fluid temperature at pump outlet is 120°F ± 10°F.

3. Increase the pump outlet pressure to 250 bar (3625 PSIG). The pump must be able to meet the flow loss requirement as stated in Table 6. Hold this condition for one minute.

4. Visually inspect shaft seal (76) for leakage throughout the performance test.

E. 'CV' & 'C' CONTROL ADJUSTMENT PROCEDURE

NOTE

To adjust the 'CV' control, perform steps 1 through 7. To adjust the 'C' control, perform steps 1, 2, 3, 6, and 7. Refer to Figures 9 and 17 during the adjustment procedure. Turn the adjusting screws clockwise to increase pressure and counterclockwise to decrease pressure.

1. Perform the preliminary set-up procedure (Section VIII-B), start-up procedure (Section VIII-C), and the performance test (Section VIII-D).

2. Set the pump to rated RPM as shown in Table 5.

3. Adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

4. Adjust valve 'B' to obtain an outlet flow that is specified in Table 7.

5. Turn load sensing screw (15) until 20 ± 1 bar (290 ± 14.5 PSID) pressure differential is obtained between 'P2' and 'P1'. Tighten nut (14).

6. Open valve 'B' and adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

PUMP MODEL	RATED SPEED (RPM)	PUMP OUTLET FLOW FOR SETTING ΔP
PVE27	2400	70 1/m (18.5 GPM)
PVE27QI	1800	50 1/m (13.2 GPM)
PVE35	2200	80 1/m (21.0 GPM)
PVE35Q	2100	75 1/m (19.8 GPM)
PVE35QI	1800	65 1/m (17.2 GPM)
PVE47	2100	105 1/m (27.7 GPM)
PVE47QI	1800	90 1/m (23.8 GPM)
PVE62	2000	130 1/m (34.0 GPM)
PVE62QI	1500	144 1/m (38.0 GPM)

Table 7. Outlet Flow Setting

7. Turn pressure compensator screw (4, 4a) until pressure at 'P2' starts to decay below 3625 PSI. Adjust screw (4, 4a) to a desired pressure level. If a pressure level is not specified, djust the screw to 250 bar (3625 PSI).

F. STABILITY AND INTERNAL CHECK VALVE TEST

NOTE

Refer to Figure 17 during the following discussion.

1. Adjust valve 'A' to obtain 28 bar (400 PSIG) outlet pressure at 'P2'. Operate the pump at rated speed (RPM) as stated in Table 5.

2. Close valve 'A' rapidly. There shall be no indication of pump instability. (Note: Pump instability is established when outlet pressure oscillations exceed ±3.5 bar (50 PSI) around the control pressure setting (3625 PSI). When valve 'A' is closed, the pressure at 'P2' shall be within ±4.0 (58 PSI) of the initial pressure setting.

3. Close needle valve 'V'. The differential pressure between 'P3' and 'P4' must be 0.9-1.7 bar (13-25 PSID). Open needle valve 'V'.

A. TEST CONDITIONS

1. Fluid entering the pump inlet must be filtered to meet an ISO (International Standard Organization) cleanliness code of 19/15 or cleaner. Selections from OFP, OFR and OFRS series filters are recommended. For recommended fluid types, refer to bulletin M-2950-S.

2. Pump inlet pressure must be maintained between 1.15 bar and 0.85 bar (2 PSIG-5 inches Hg).

3. Operate the pump at a fluid temperature of 120°F ±10°F.

4. PVE operating parameters are listed in Table 5.

PUMP MODEL	RATED PRESSURE (PSI)	RATED SPEED (RPM)	RATED DISPLACEMENT (CIR)
PVE27	3625	2400	3.5
PVE27QI	3625	1800	3.5
PVE35	3625	2200	4.5
PVE35Q	3625	2100	4.5
PVE35QI	3625	1800	4.5
PVE47	3625	2100	6.0
PVE47QI	3625	1800	6.0
PVE62	3625	2000	8.0
PVE62QI	3625	1500	8.0

Table 5. PVE Operating Parameters.

B. PRELIMINARY SET-UP

1. If a hydraulic test stand is available with adequate horsepower capabilities, mount the pump on the test stand. If a test stand is not available, mount the pump on the vehicle and proceed to connect the hydraulic lines to the pump. Refer to Section IV for pump installation instructions.

2. Connect the case line, inlet and outlet line, load sensing line (if required), pressure gauges, and other equipment as described in Figure 17. Make sure all connections are tight.

3. Remove drain plug (28) from valve block (33) and fill the pump with clean hydraulic fluid. Reinstall the plug and torque to value noted in Table 4.

NOTE
The following step describes the preliminary setting of the PVE control adjustment screws (15, 4, 4a) prior to test. Refer to Figure 9 for screw locations.

4. Turn the control adjustment screws as follows:

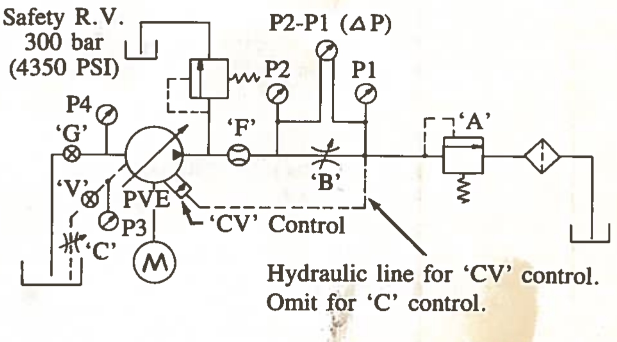
a. PVE27/35/47/62 pump with 'CV' control: Turn ing screw (15) clockwise until it bottoms out. Turn screw (4) clockwise until it bottoms out, (4) two full turns.

/47/62 pump with 'C' control: Turn screw (4a) clockwise until it bottoms out, ew (4a) two full turns.

C. START-UP

NOTE
Refer to Figure 17 during the following discussion.

'A' = Load Valve
'B' = Flow Control or Load Sensing Valve
'C' = Internal Check Valve
'G' = Globe Valve (Inlet)
'V' = Needle Valve
'F' = Flow Meter
P1 = Pressure Gauges (5000 PSI)
P2 = Pressure Gauge
P3 = Case Drain Pressure Gauge
P4 = Inlet Pressure Gauge



Note: Valve 'B' and pressure gauge P1 not required for PVE with 'C' control.

Figure 17. PVE Test Circuit

1. Fully open valve 'G' and 'V'.

2. Fully open valve 'B' and set valve 'A' to minimum pressure setting.

3. Start the test stand or vehicle engine. Operate the pump at 600 RPM and at minimum outlet pressure. Check the system for leaks and unusual noise. Increase the pump to 1200 RPM until all the air is purged out of the system.

CAUTION
If unusual noise is noted, shut down the system immediately to avoid pump damage. Refer to the Troubleshooting Chart (Table 3) for possible repair solution.

D. PERFORMANCE TEST

NOTE
Refer to Figure 17 during the following discussion.

1. Increase the pump to the rated speed (RPM) as specified in Table 5. Adjust valve 'A' until 28 bar (400 PSIG) outlet pressure is obtained at 'P2'. Hold this condition until the air is purged out of system.

12. Lubricate cylinder block (56) with clean hydraulic fluid. Install the nine piston S/A (62) into shoe plate (61) as shown.

13. Install spacer limiter (55) over the cylinder block against the outer diameter of shoe plate (61). Rotate the spacer limiter so the spacer limiter notch lines up with the hole in the yoke hub.

14. Feed the nine pistons (62) into the cylinder block bores. Then install rotating parts 56 through 62 into yoke (71) against swash plate (72).

15. Insert pin (54) into yoke hub so that it fully engages into the spacer limiter notch. *(This step is very critical. If pin (54) does not engage into the spacer limiter notch, the pump will experience early failure.)*

16. Install pintle cover (51). Tighten screws (50) to 15-18 Nm. (11-13 lb. ft.).

17. Install shims (49) to end of shaft (68).

18. Install tail bearing (48) on shaft (68) next to shims (49).

19. If required, assemble o-ring (43) on bias stem (42) and o-ring (39) on control stem (38). Apply one drop of Loctite 270 cement to bias and control stem threads. Install the bias and control stems into valve block (33). Secure the stems with a hex key wrench.

20. Assemble spring (41) and piston (40) on bias stem (42). Install piston (37) on control stem (38).

21. Insert pin (36) into valve block (33).

22. Lubricate valve block face with a light film of clean hydraulic fluid.

23. Place valve plate (34) on valve block face with bronze side face up. (Note: The notch on valve plate (34) must fit over pin (36)).

24. Carefully assemble valve block (33) onto housing (77). Make sure the bias spring (41) and bias piston (42) are in place against the yoke pad during the assembly process. If the spring or piston falls off the bias stem (43), apply a liberal amount of petroleum jelly to the spring and piston.

25. Install screws (32) hand tight. Remove the two studs from housing (77) and install the remaining two screws (32). Cross tighten the screws to 50-55 Nm (37-41 lb. ft.).

26. Assemble o-rings (31 and 29) on plugs (30 and 28). Install the plugs into valve block (33). Tighten the plugs to value noted in Table 4.

MODEL	PLUG	TORQUE (Nm)	TORQUE (lb. ft.)
PVE27/35	10, 10a, 21, 24	18 - 20	13 - 15
	26	40 - 45	30 - 33
	28	54 - 59	40 - 43
	30	15 - 16	11 - 12
PVE47	10, 10a 21, 24	18 - 20	13 - 15
	26	40 - 45	30 - 33
	28	75 - 83	55 - 61
	30	15 - 16	11 - 12
PVE62	28	41 - 49	30 - 36
	30	14 - 19	10 - 14

Table 4. Plug Torque

G. PVE CONTROL ASSEMBLY

'CV' CONTROL

NOTE

The following steps (1 through 12) describe the assembly procedure for PVE27/35/47/62 pumps with a 'CV' control. This control is assembled in reverse item number sequence order as shown in Figure 9.

1. Assemble o-rings (27 & 25) on plugs (26 & 24). Install the plugs into compensator body (13) as shown. Tighten the plugs to the value listed in Table 4.

2. Lubricate load sensing spool (23) and install it into compensator body (13) as shown.

3. Assemble o-ring (22) on plug (21). Install the plug into compensator body (13). Tighten the plug to the value listed into Table 4.

4. Install spring guide (20) and spring (19).

5. Assemble o-ring (17) on spring seat (16). Then assemble back-up ring (18).

6. Install spring seat (16) and adjusting screw (15) into body (13). Install nut (14) on adjusting screw (15) hand tight.

7. Lubricate compensator spool (12) and install it into body (13) as shown.

8. Assemble o-ring (11) on plug (10). Install the plug into body (13) and tighten to the value listed in Table 4.

9. Install spring guide (9) and spring (8) into body (13).

10. Assemble o-ring (7) on spring seat (6). Install spring seat (6) and plug (5) into body (13).

11. Assemble adjusting screw (4) into plug (5) until spring tension is felt. Install nut (3) on adjusting screw (4) hand tight.

12. Install three o-rings (2) on control mounting surface. Align the o-rings with holes in valve block (33) mounting pad. Install the control to valve block (33) with four screws (1). Cross tighten the screws to 31-37 Nm (23-28 lb. ft.).

'C' Control

NOTE

The following steps (1 through 5) describe the assembly procedure for the 'C' control. Refer to Figure 9.

1. Assemble o-ring (11a) on plug (10a). Install the plug into body (13a) and tighten to the value noted in Table 4.

2. Install spring guide (9a) and spring (8a) into body (13a).

3. Assemble o-ring (7a) on spring seat (6a). Install spring seat and plug (5a) into body (13a).

4. Assemble adjusting screw (4a) into plug (5a) until spring tension is felt. Install nut (3a) on adjusting screw (4a) hand tight.

5. Install three o-rings (2a) on body mounting surface Align the o-rings with holes in valve block (33) mounting p Install the control to valve block (33) with four screws (1a). tighten the screws to 31-37 Nm (23-28 lb. ft.).

a. Position housing (77) so that the pin hole in yoke hub is exposed.

b. Assemble spacer (53) on top of pintle bearing (70). Install o-ring (52) into housing groove. Fasten cover (51) to housing with four screws (50). Tighten the screws to 15-18 Nm (11-13 lb. ft.).

c. Position the housing to assemble parts 67 through 63. Make sure the yoke hub *DOES NOT* have a pin hole.

d. If a new yoke (71) and/or pintle bearings (69, 70) are used, install .025/.027 shim (67) thickness on top of pintle bearing (69). If the yoke and/or pintle bearings are not replaced, install the shims (67) that were removed at disassembly.

NOTE

Always install shim (67) at pintle area of housing that does not have a pin hole in yoke hub.

e. Install spacer (66), o-ring (65), and cover (64). Fasten cover (64) to housing (77) with four screws (63). Tighten the screws to 15-18 Nm (11-13 lb. ft.).

f. Push on the yoke pad as shown in Figure 16. The force to move the yoke (71) should be between 10-15 lbs. If the force is too low, shims (67) must be added. If the force is too high, shims (67) must be removed. (Note: .001 shim thickness equals approximately 1 lb.). If the force is between 10-15 lbs., proceed to step 9. If the force is too low or too high, remove parts (63, 64 and 66) and adjust shim (67) thickness to obtain 10-15 lb. force.

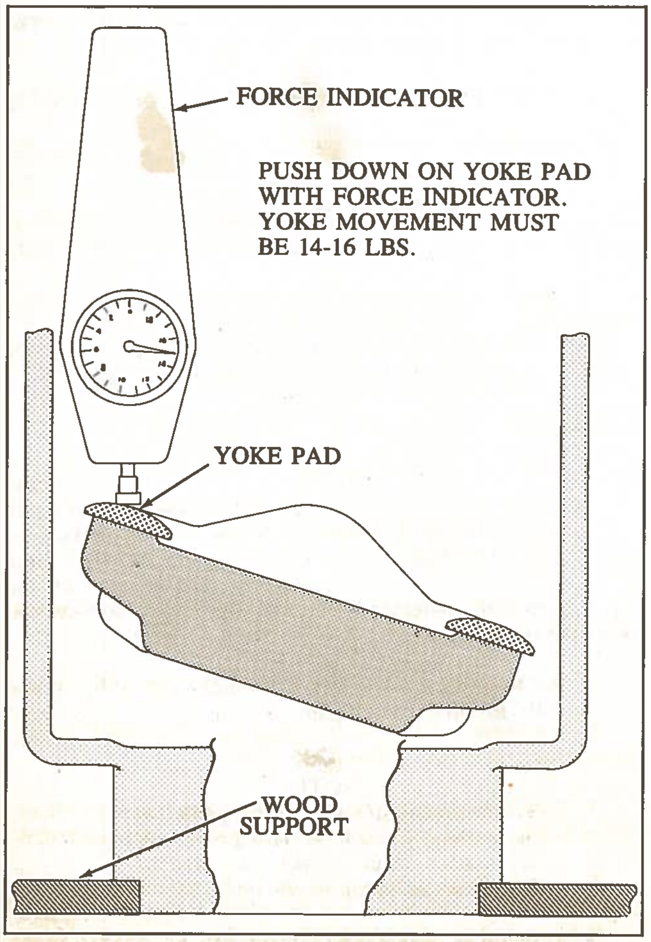

FORCE INDICATOR
PUSH DOWN ON YOKE PAD WITH FORCE INDICATOR. YOKE MOVEMENT MUST BE 14-16 LBS.
YOKE PAD
WOOD SUPPORT

Figure 16. Yoke Force

NOTE

The following step describes the shaft end play procedure. This procedure is necessary to insure proper pump operation. Final shaft end play must be 0.001-0.004.

9. Obtain a shaft spacer kit as noted in the parts drawing. Perform the following steps:

a. If bias and control parts (37 through 43) are attached to valve block (33), remove parts 37, 40 and 41.

b. If pins (44) were removed, install two new pins into housing (77).

c. Install housing gasket (35) against housing.

d. Install tail bearing (48) on end of shaft (68) so the bearing rollers match up with bearing race within the valve block (33).

NOTE

If bearing race (48) was removed from valve block (33), install a new bearing race into valve block. Refer to Figure 14 for instructions.

e. Position valve block (33) on the two studs and carefully slide the valve block against housing gasket (35). Make sure mounting pins (44) engage properly into valve block.

f. Apply a small amount of hydraulic fluid to screw (32) threads. Secure the valve block (33) to housing (77) with six screws (32). Tighten the screws to 50-55 Nm (37-41 lb. ft.).

g. Set the pump on the work bench so that shaft (68) is straight up (vertical). Push down on shaft to insure bearings (48, 74) are seated.

h. Place a dial indicator at end of shaft (68). Set the dial indicator to 0.00.

i. Place vice grip pliers underneath shaft spline and lift up on shaft (68).

j. Observe the dial indicator reading to determine the amount of shaft movement. For example: If dial indicator needle reads 0.040, a 0.036-0.039 shim (49) thickness must be added to end of shaft to obtain a 0.001-0.004 shaft end play (0.040 minus 0.036-0.039 equals 0.001-0.004). Repeat this step two times to insure a proper measurement.

k. Remove valve block (33) from housing (77). Remove tail bearing (48) from end of shaft (68).

l. Install shims (49) to end of shaft (68) according to the measurement obtained in step 'j'.

m. Install tail bearing (48) on end of shaft (68) next to shims (49).

n. Repeat steps 'e' through 'j'. If 0.001/0.004 shaft end play is obtained, proceed to step 'o'.

o. Remove valve block (33), tail bearing (48), and shims (49) from pump. Set these parts aside for final assembly.

10. Remove pintle cover (51) from housing (77).

11. If required, assemble rotating group prts 60 through 57 into cylinder block (56). Use the spring decompression tool as shown in Figure 6a.

NOTE

Obtain a new seal kit. Refer to the appropriate part drawing as listed in Table 2 for the seal kit part number. Apply a light film of clean hydraulic fluid to the new seals. This will make assembly easier and also provide initial lubrication of moving parts. Assemble the piston pump as follows:

1. If shaft seal (76) was removed, install a new shaft seal into pump housing (77). Lubricate the shaft seal and housing bore with petroleum jelly before assembly. Use an arbor press and the shaft seal assembly tool. The shaft seal assembly tool is shown in Figure 8. Make sure the spring member of the shaft seal is face up during assembly.

2. Install retaining ring (75) into the second groove within the housing bore next to the shaft seal. Use Truarc pliers for this operation.

3. If bearing race (74) was removed from housing (77) install a new bearing race into housing with an arbor press. Make sure the bearing race is face up to accommodate the matching roller bearing. Press the bearing race until it rests at bottom of housing. Use the bearing race tool as described in Figure 14. After the bearing race is installed, apply a liberal amount of petroleum jelly to the matching roller bearing. Install the roller bearing into the bearing race.

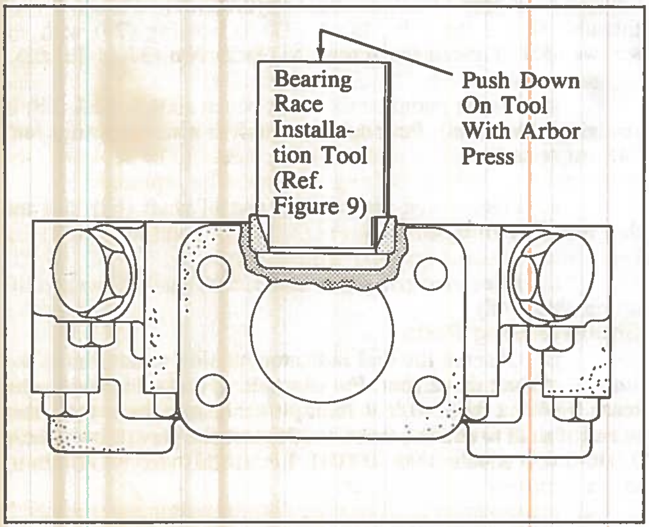


Figure 14. Installation of Bearing Race (48) into Valve Block (33).

4. Install pin (73) into yoke (71).

5. Apply a thin coat of clean hydraulic fluid on both sides of swash plate (72). Align pin (73) with hole in swash plate (72), then install swash plate (72) into yoke.

NOTE

The following step describes the assembly of shaft (68) into housing (77). Refer to Figure 15 during this process.

6. Install shaft (68) as follows:

a. Lubricate roller bearing (74) and shaft (68). Assemble roller bearing (74) on shaft (68).

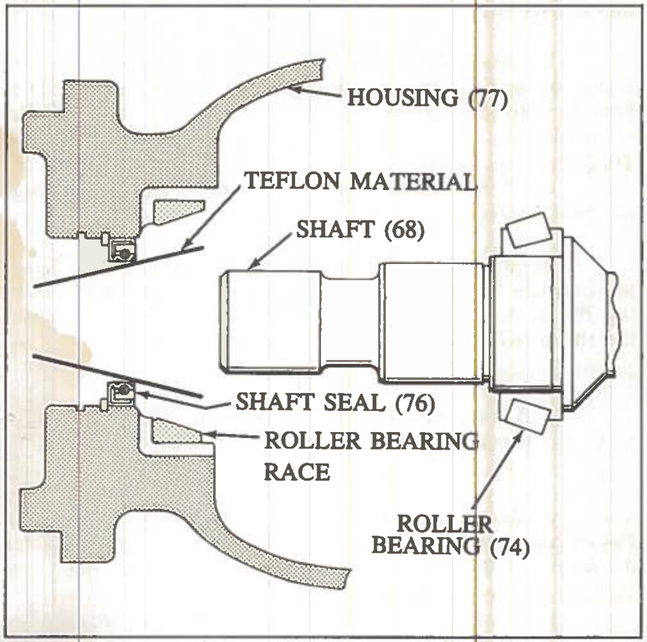


Figure 15. Shaft (68) Installation

b. Take a piece of shim stock or teflon material (8″ × 3″ × .003″) and roll it into a funnel shape. Insert the teflon material into the shat seal (76) as shown.

c. Install shaft (68) into housing (77). (NOTE: The teflon material will be forced out of shaft seal during this process.)

7. If yoke (71) was removed from housing (77), assemble the yoke into housing as follows:

a. Place the pump housing on its side with pintle bearing (70) area of housing face up.

b. Insert yoke (71) into housing (77) so that both yoke hubs are centered at pintle area of housing.

NOTE

The pin hole in the yoke hub *MUST* be exposed. If the pin hole is not exposed, turn the yoke 180°.

c. Lubricate pintle bearing (70) with clean hydraulic fluid. Orient the bearing to match the bearing race. Install pintle bearing (70) onto yoke hub. Next, carefully insert the bearing race over the pintle bearing and into the housing. *DO NOT* force the bearing race if it does not fit properly. Simply reposition the yoke hub directly underneath the pintle opening of housing and insert the bearing race.

d. Position the housing to assemble the other pintle bearing (69). Install the bearing into housing as described in step 'c'.

NOTE

The following step describes a pintle bearing preload procedure. This procedure is necessary to insure proper yoke movement during actual pump operation.

8. If required, obtain a new pintle shim kit as noted in the parts drawing. Perform the following steps (a through f).

E. INSPECTION, REPAIR, AND PART REPLACEMENT

NOTE
Before inspection of parts, clean all parts with a solvent that is compatible with system fluid.

√ ~~PVE~~ C Control Parts

1. Inspect all parts for wear and/or erosion.

2. Inspect the plugs and screws for damaged threads, burrs, etc. Replace any plug or screw that has damaged threads.

3. Inspect springs for squareness. The spring ends must be parallel within three degrees (3°).

4. Check each spool for proper movement within the body S/A. A lubricated spool *must* move freely under the influence of gravity. Check the spool orifice for restriction. To clean the spool orifice, pour some clean solvent in a squeeze bottle. then apply the solvent to the nose end of the spool and observe the flow of solvent from the spool orifice.

Rotating Group Parts

1. Inspect cylinder block face (56) for wear, scratches, and/or erosion. If cylinder block condition is questionable, replace the entire rotating group.

2. Check each cylinder block bore for excessive wear. Use the piston and shoe S/A (62) for this purpose. The pistons should be a very close fit and slide in and out of cylinder block bores. *NO BINDING CAN BE TOLERATED.* If binding occurs, clean the cylinder block and pistons. Lubricate the cylinder block bores with clean fluid and try again. Even minor contamination of the fluid may cause a piston to freeze up in a cylinder bore.

3. Inspect each of the nine piston and shoe subassemblies (62) for a maximum end play of 0.005 inch between the piston and shoe. Also check the face dimension of each shoe. The face dimension must be within 0.001 inch. See Figure 13.

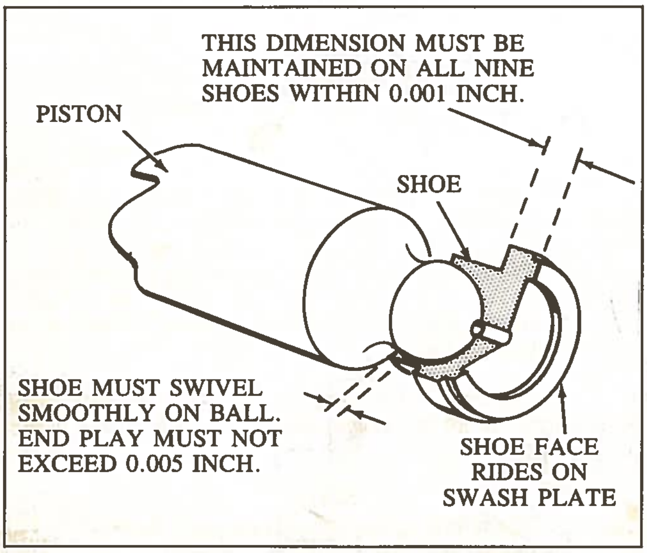

THIS DIMENSION MUST BE MAINTAINED ON ALL NINE SHOES WITHIN 0.001 INCH.
PISTON
SHOE
SHOE MUST SWIVEL SMOOTHLY ON BALL. END PLAY MUST NOT EXCEED 0.005 INCH.
SHOE FACE RIDES ON SWASH PLATE

Figure 13. Piston S/A (62) Tolerances

4. Inspect the shoe plate (61) for heavy wear and cracks. If heavy wear and/or cracks are found, replace the shoe plate.

Valve Block & Associated Parts

1. Inspect valve block (33) for erosion, cracks, and burrs. Clean up minor burrs with an India stone. If erosion or cracks are noted, replace the valve block.

2. Inspect roller bearing and bearing race (48) for nicks and pitting. Make sure the roller bearing turns freely within the bearing race. If the roller bearing needs replacement, both the roller bearing and the bearing race mut be replaced. To remove bearing race from valve block, refer to Figure 10.

3. Inspect valve plate (34) for erosion, excessive wear, heavy scratches, and cracks. If any of the above conditions are found, replace the valve plate.

4. Inspect control and bias piston parts (37, 38, 40, 41, 42) for burrs, scratches, and cracks. Clean up minor scratches with 500 grit paper. Remove burrs with an India stone. The control and bias piston (37, 40) should move freely over the respective control stem and bias stem (38, 42).

Yoke Parts

1. Inspect yoke (71) face for wear, roughness or scoring. Check the yoke hubs (pintle bearing surfaces) for wear and cracks. Replace the yoke, if defective.

2. Inspect the face of swash plate (72) for wear, scratches, and possible fracture. Replace, if defective.

3. Inspect the limiter spacer (55) for heavy wear and cracks. Replace, if defective.

4. Inspect pintle bearings (~~69 and 70~~) for wear, pitting, and smooth operation. If a pintle bearing needs to be replaced, the roller bearing and the bearing race must be replaced.

5. Check the pintle spacers (~~53 and 66~~) and shims (67) for burrs and flatness. Replace, if necessary.

Shaft/Housing Parts

1. Inspect drive shaft (68) for wear, shipped splines, and burrs. Remove burrs with an India stone. Inspect the contact area of bearing (74) and shaft seal (76). Replace the drive shaft if wear or scoring is greater than 0.005 T.I.R. (total indicator reading).

2. Inspect drive shaft bearing (74) for roughness, pitting of rollers, and excessive end play. Replace, if defective. If the bearing needs to be replaced, the bearing race inside the housing (77) also requires replacement. To remove the bearing race from the housing, refer to Figure 11.

3. Inspect housing (77) mounting flange for nicks and burrs. Remove minor nicks and burrs with an India stone. Also check the housing for damaged or stripped threads. If any thread is damaged, replace the housing.

4. Check remaining pump parts for excessive wear, damaged threads, burrs, cracks, and erosion. Replace any part that is in a questionable condition. √

F. ASSEMBLY

Assembly is generally performed in the reverse order of disassembly. Refer to Figure 9 during the following assembly procedure.

2. Secure housing (77) in a vice so that shaft (68) is in a horizontal position.

3. Remove shaft (68) from housing (77) by tapping on spline end of shaft with a rubber hammer.

4. Move yoke (71) side to side against pintle bearings (69, 70) until the yoke hubs dislodge from the pintle bearings.

5. Remove pintle bearings (69, 70) from housing (77).

6. Remove yoke (71) from housing (77).

7. Wash yoke (71) in clean solvent, then remove swash plate (72) from yoke. *DO NOT* remove pin (73) from yoke unless damaged. If a new yoke is installed, obtain a new pin (73).

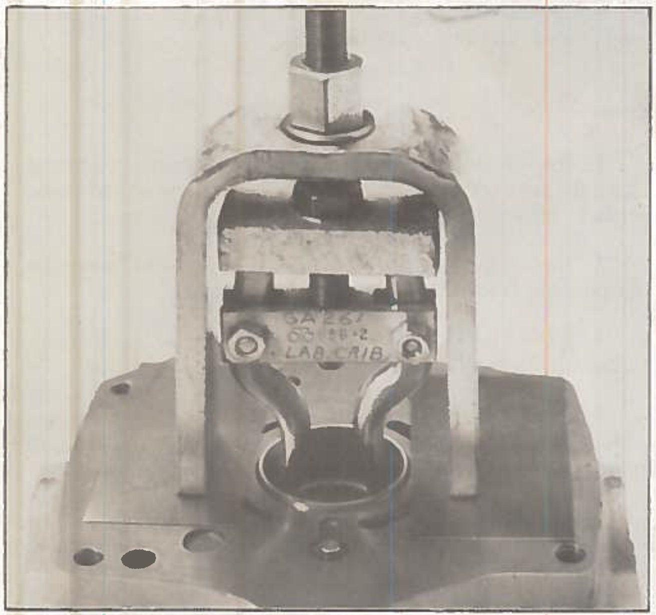


Figure 10. Removal of Bearing Race (48) from Valve Block (33).

Bearing & Shaft Seal Removal (Items 48, 74, 75, 76)

1. Remove roller bearing (74) from housing (77).

2. Inspect roller bearings (48 and 74) for pitting and cracks. Turn roller bearings in their associated bearing race and check for roughness and bind. The roller bearings must turn freely within the bearing race with no signs of bind. If a roller bearing shows evidence of bind, wash the bearing in a clean solvent and recheck for bind. If binding persists, replace the roller bearing and bearing race. Refer to Figures 10 and 11 for the bearing race removal procedure.

3. Remove retaining ring (75) from housing (77) with Truarc pliers.

4. Remove shaft seal (76) from housing (77). Refer to Figure 12 for instructions.

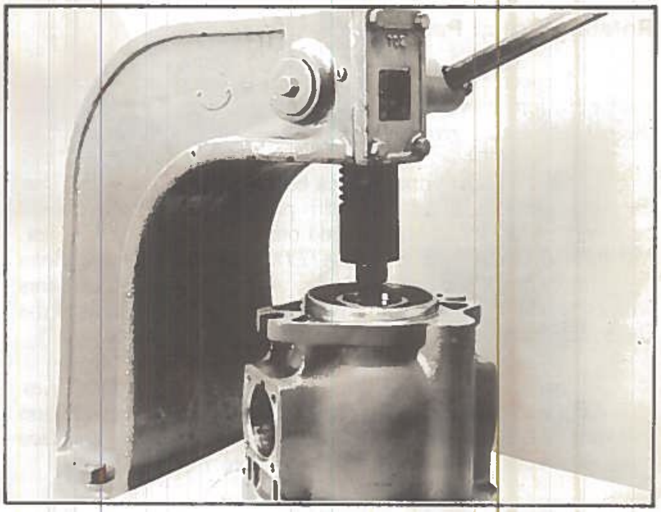
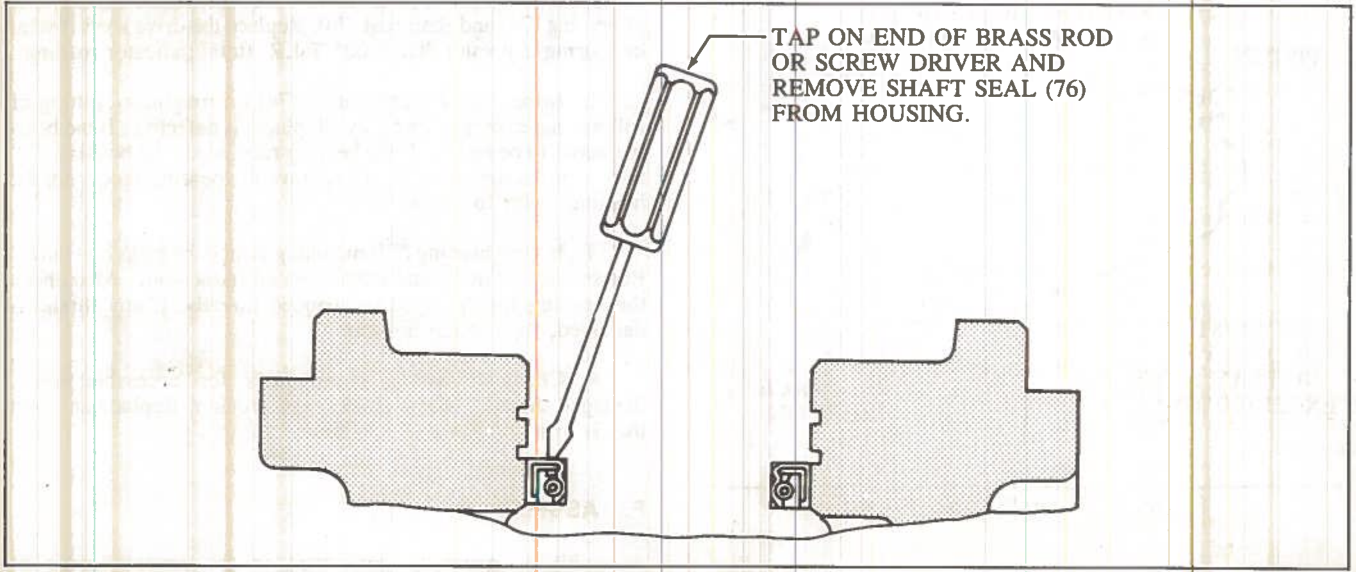


Figure 11. Removal of Front Bearing Race (74).



TAP ON END OF BRASS ROD OR SCREW DRIVER AND REMOVE SHAFT SEAL (76) FROM HOUSING.

Figure 12. Shaft Seal (76) Removal.

6. Remove parts (6) through (9) from control body (13). Remove o-ring (7) from spring retainer (6).

7. Remove plug (10). Remove o-ring (11) from plug (10).

8. Remove spool (12).

9. Loosen nut (14) and remove parts (15) through (20) from control body. Remove o-ring (18) and back-up ring (17) from spring retainer (16).

10. Remove plug (21). Remove o-ring (22) from plug (21).

11. Remove load sensing spool ()23) from control housing bore.

12. Remove plugs (24) and (26). Remove o-rings (25) and (27) from the plugs.

13. Discard all o-rings and back-up ring.

Valve Block Disassembly (Items 30 through 49)

NOTE

Refer back to Figure 9, PVE exploded view, for following disassembly procedures.

1. Remove plug (30) and o-ring (31) from valve block (33).

2. Loosen the eight screws (32) that attach the valve block to the pump housing (77).

3. At this time, remove two screws (32) that are opposite of each other and replace these screws with two studs. The studs are referenced in Section VII-B, Special Tools.

4. Remove the remaining six screws from the valve block.

5. Remove the valve block from the pump housing.

NOTE

To dislodge valve block (33) from the housing (77), tap on side of valve block with a rubber hammer. Slowly remove the valve block away from the housing. The studs will act as a guide during this procedure. (Note: The valve plate (34) may stick to the cylinder block (56) or valve block (33) during removal of the valve block.) Be careful not to damage the valve plate or valve block during this operation. Once the valve block moves away, do not allow the valve block to move back against the pump housing (77) because the valve plate may get damaged.

6. Remove valve plate (34).

7. Remove and discard housing gasket (35).

8. Remove pin (36) from valve block (33).

9. Remove control piston (37), bias piston (40), and bias spring (41). *DO NOT* remove control stem (38), o-ring (39), bias stem (42), and o-ring (43) from valve block (33) unless they are damaged.

NOTE

If control stem (38) or bias stem (42) needs to be removed from valve block (33), secure the valve block in a sturdy vise. Make sure the vise jaws do not damage the valve block face. Insert a hex key wrench into the stem and turn the wrench counterclockwise. It may be necessary to use an extension on the wrench because the control and bias stem are secured to the valve block with Loctite 270 cement. Remove o-ring (39) and o-ring (43) from the stems.

10. *DO NOT* remove pin (44) from housing (77) unless damaged. If pin removal is necessary, use vice grip pliers.

11. Take a blunt screwdriver and push down on poppet (46). The poppet is located in the valve block face underneath seat (45). Release the screw driver from the poppet and check to see if the poppet returns against seat (45). *DO NOT* remove seat (45), poppet (46), and spring (47) from valve block (33) if the poppet returns against the seat.

12. Remove roller bearing (48) and shims (49) from end of shaft (68).

Rotating Group Removal (Items 50 through 62)

1. Remove the four screws (50) that hold pintle cover (51) to pump housing (77). Remove pintle cover (51), o-ring (52), and spacer (53). Discard o-ring (52).

2. Remove pin (54) from yoke hub.

3. Reach into pump housing (77) and rotate spacer (55) so that the lobes on the spacer unlock shoe plate (61) from yoke (71).

4. Reach in with both hands and remove the complete rotating group from housing (77). The complete rotating group consists of items 55 through 62.

WARNING

DO NOT remove retaining ring (57) from cylinder block (56) because spring (59) is under high compression. Bodily harm may result if the retaining ring is removed without adequate caution. In most cases, the parts inside the cylinder block will not require removal. However, if spring (59) is damaged, the parts within the cylinder block must be removed. See Figure 6 for disassembly instructions.

Shaft and Yoke Removal (Items 63 through 73)

NOTE

Shaft (68) and/or (71) removal is necessary if any of the following conditions are noted.

a. Damage at bearing surface or spline area of shaft (68).

b. Yoke (71) bind (i.e. yoke does not move freely back and forth within pump housing).

c. The yoke shows evidence of heavy wear or cracks.

d. The pintle bearings (69 or 70) are worn or defective.

e. Shaft seal (76) leakage noted during pump operation.

NOTE

If any of the above conditions are noted, perform the following steps.

1. Remove the four screws (63) from pintle cover (64), then remove pintle cover (64), o-ring (65), spacer (66), and shims (67).

the parts makes this requirement very important. Clean all parts that are removed from the unit with a commercial solvent that is compatible with the system fluid. Compressed air may be used in the cleaning process, however, it must be filtered to remove water and any other contamination.

NOTE

Refer to Figure 9 for the following disassembly procedure.

PVE27/35/47/62 Control Disassembly (Items 1-27 or 1a-13a)

NOTE

If the unit has a load sensing 'CV' control, follow item numbers 1 through 27 as shown in Figure 9. If the unit has a pressure compensator 'C' control, follow item numbers 1a through 13a. The following procedure describes the disassembly of a 'CV control.

1. Loosen the four screws (1) from the control and remove the control from valve block (33).

2. Remove o-rings (2) from the control mounting surface.

3. Secure the control in a bench vice.

4. Remove nut (3) from adjusting screw (4), then remove the adjusting screw from retainer plug (5).

5. Use a large nut wrench and remove retainer plug (5) from control body (13).

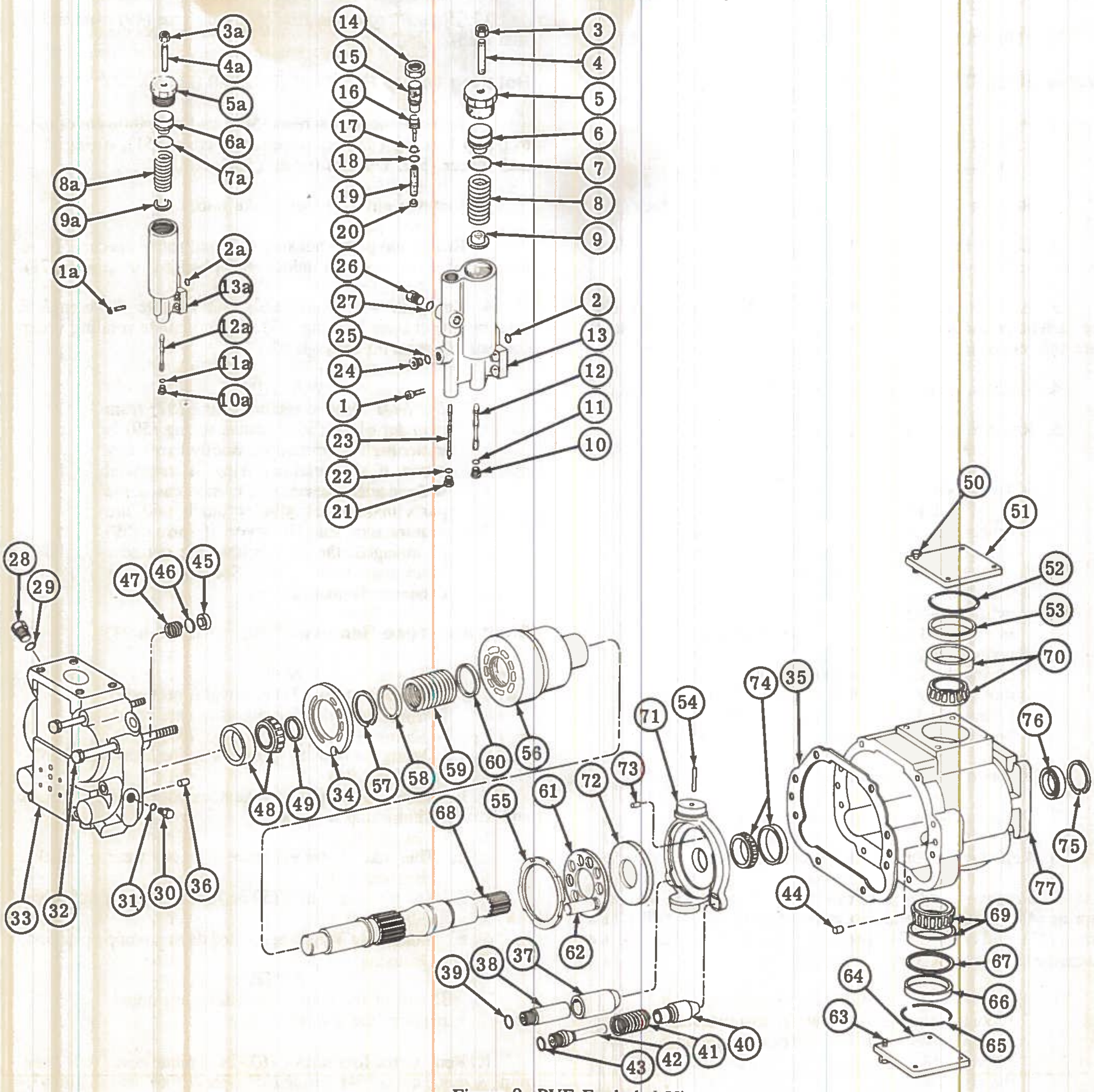


Figure 9. PVE Exploded View

C. UNIT REMOVAL

1. Block the vehicle if it is on a slope to prevent uncontrolled movement.

CAUTION

Before breaking the circuit connection, make sure power is off and system pressure is released. Lower all vertical cylinders, discharge accumulators, and block any load that could generate pressure.

2. Drain the fluid from the system.

3. Remove drain plug (28) from the pump's valve block (33) and drain the fluid from the pump.

4. Before breaking any circuit connections at the pump, clean the pump exterior to prevent dirt from entering the system.

5. Disconnect all hydraulic lines at the pump.

6. Remove the unit from the vehicle. Use a chain fall.

7. Put the unit on a clean, steel work bench that will support the unit's weight.

CAUTION

Cleanliness is essential when working on a hydraulic system or system component. Always work in a clean area. Contamination can cause serious damage to a hydraulic system.

8. Before unit disassembly, cap or plug all open circuit connections on the vehicle so dirt does not enter the system.

D. UNIT DISASSEMBLY

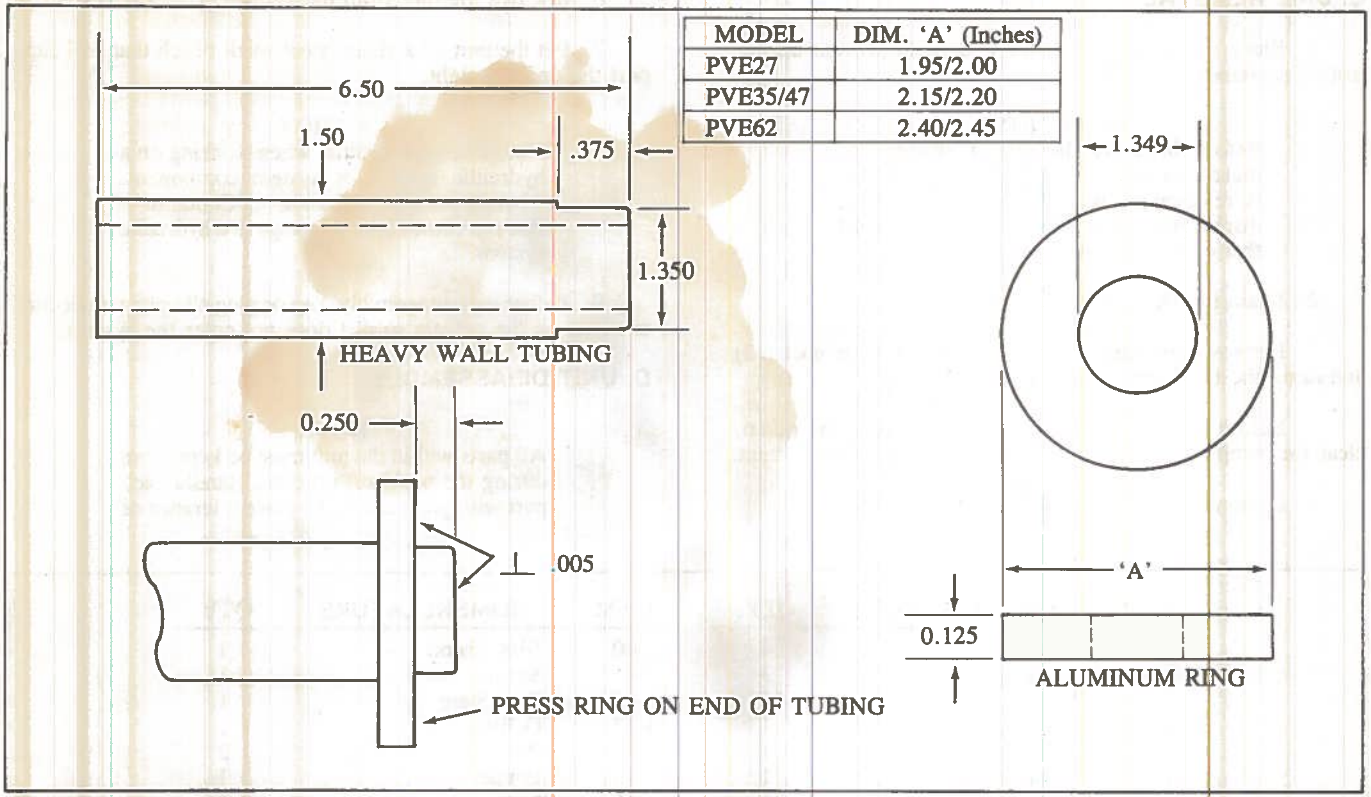
NOTE

All parts within the unit must be kept clean during the overhaul process. Handle each part with great care. The close tolerance of

ITEM	NOMENCLATURE	QTY.	ITEM	NOMENCLATURE	QTY.
1, 1a	Screw	4	40	Bias Piston	1
▲2, 2a	O-Ring	3	41	Spring	1
3, 3a	Nut	1	42	Bias Stem	1
4, 4a	Adjustment Screw	1	▲43	O-Ring	1
5, 5a	Plug	1	44	Pin	2
6, 6a	Spring Seat	1	45	Poppet	1
▲7, 7a	O-Ring	1	46	Seat	1
8, 8a	Spring	1	47	Spring	1
9, 9a	Spring Guide	1	48	Bearing S/A	1
10, 10a	Plug	1	49	Shim (Spacer)	A/R
▲11, 11a	O-Ring	1	50	Screw	4
12, 12a	Press. Comp. Spool	1	51	Cover	1
13, 13a	Control Body	1	▲52	O-Ring	1
14	Nut	1	53	Spacer	1
15	Adjustment Screw	1	54	Pin	1
16	Spring Seat	1	55	Spacer Limiter	1
▲17	Back-Up Ring	1	56	Cylinder Block S/A	1
▲18	O-Ring	1	57	Retaining Ring	1
19	Spring	1	58	Spring Guide	1
20	Spring Guide	1	59	Spring	1
21	Plug	1	60	Spring Guide	1
▲22	O-Ring	1	61	Shoe Plate	1
23	Load Sensing Spool	1	62	Piston S/A	9
24	Plug	1	63	Screw	4
▲25	O-Ring	1	64	Cover	1
26	Plug	1	▲65	O-Ring	1
▲27	O-Ring	1	66	Spacer	1
28	Plug	1	67	Shim	A/R
▲29	O-Ring	1	68	Shaft	1
30	Plug	1	69	Bearing S/A	1
▲31	O-Ring	1	70	Bearing S/A	1
32	Screw	8	71	Yoke	1
33	Valve Block	1	72	Swash Plate	1
34	Valve Plate	1	73	Pin	1
▲35	Gasket	1	74	Bearing S/A	1
36	Pin	1			
37	Control Piston	1	▲75	Shaft Seal	1
38	Control Stem	1	76	Retaining Ring	1
▲39	O-Ring	1	77	Housing	1

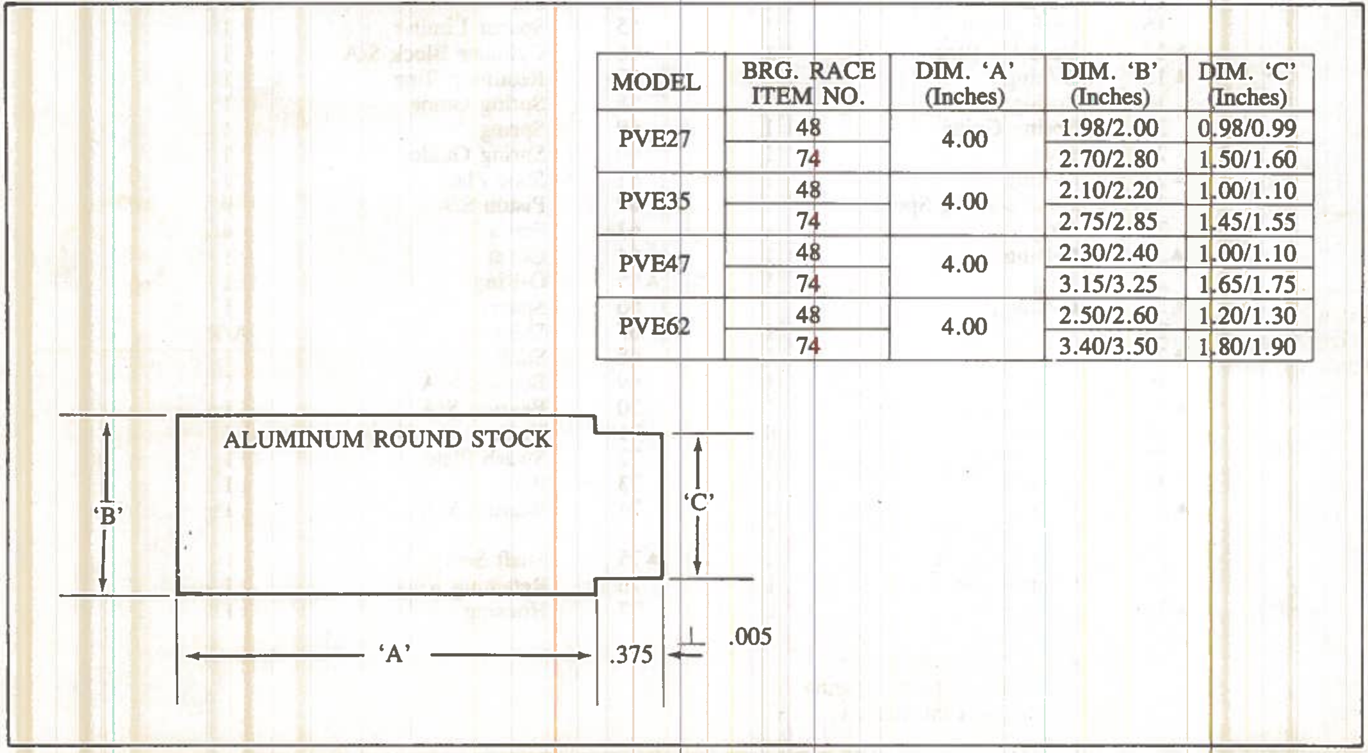
▲ – Included in seal kit.
Refer to parts drawing
for seal kit number.

Figure 9. Part Nomenclature



MODEL	DIM. 'A' (Inches)
PVE27	1.95/2.00
PVE35/47	2.15/2.20
PVE62	2.40/2.45

Figure 7. Shaft Seal Driver.



MODEL	BRG. RACE ITEM NO.	DIM. 'A' (Inches)	DIM. 'B' (Inches)	DIM. 'C' (Inches)
PVE27	48	4.00	1.98/2.00	0.98/0.99
	74		2.70/2.80	1.50/1.60
PVE35	48	4.00	2.10/2.20	1.00/1.10
	74		2.75/2.85	1.45/1.55
PVE47	48	4.00	2.30/2.40	1.00/1.10
	74		3.15/3.25	1.65/1.75
PVE62	48	4.00	2.50/2.60	1.20/1.30
	74		3.40/3.50	1.80/1.90

Figure 8. Bearing Race Installation Tool.

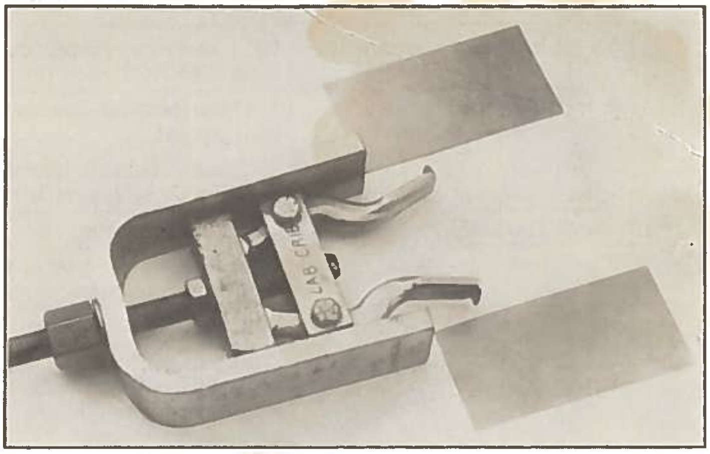


Figure 5. Valve Block Bearing Race Removal Tool and Shim Stock.

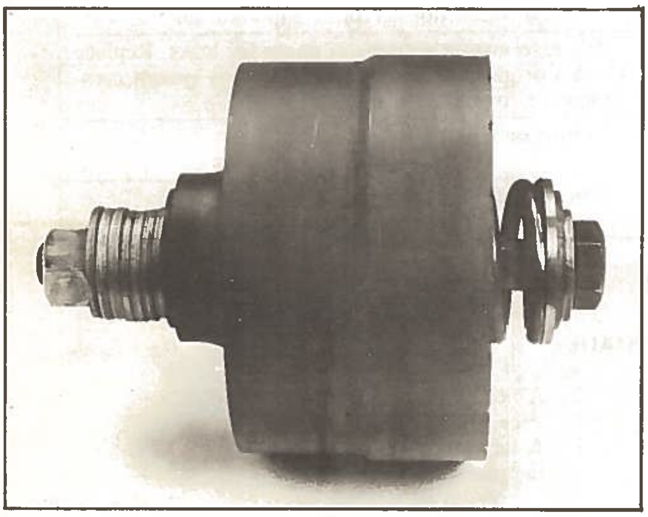


Figure 6. Cylinder Block Subassembly Disassembly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

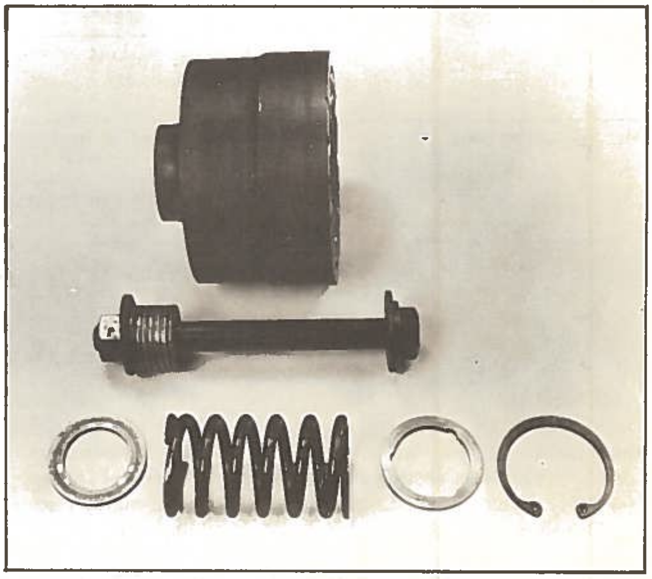


Figure 6a. Cylinder Block Subassembly Parts.

Section VI – TROUBLESHOOTING

The troubleshooting chart (Table 3) lists common difficulties experienced with pumps and hydraulic systems. The chart indicates probable causes and remedies for each of the troubles listed.

TROUBLE	PROBABLE CAUSE	REMEDY
I. Excessive noise in pump.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended fluid. DO NOT over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	Check inlet (suction) lines and fittings for air leaks.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief valve open.	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair
IV. Loss of fluid.	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating sections of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Misadjusted or broken pump control.	Adjust or replace pump control.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 3. Troubleshooting Chart

Section VII – OVERHAUL

A. GENERAL

In most cases, the pump will not require a complete overhaul as described within this section of the manual. In general, pump disassembly is accomplished according to the item number sequence as shown in Figure 9. For pump assembly, reverse the item number sequence. The item number sequence can also be used as a guide for partial disassembly and assembly. If the pump needs a complete overhaul, obtain the necessary service tools listed in Section VII-B. Repair of this unit is intricate and should not be attempted without proper tools.

B. SERVICE TOOLS

1. Standard Tools
   - a. A torque wrench (50 lb. ft. max.) with a short extension.
   - b. A ½″ and ⅝″ socket.
   - c. A set of hex key wrenches with a socket adaptor.
   - d. A 6″ crescent wrench.
   - e. A feeler gage.
   - f. A medium size screwdriver.
   - g. A rubber tip hammer.
   - h. A needle nose pliers.
   - i. Vice grip pliers.
   - j. A large nut wrench that opens to 2 inches.
   - k. Internal Truarc pliers.
   - l. Petroleum jelly lubricant or equivalent that is compatible with system fluid.
   - m. Cleaning solvent that is compatible with system fluid.
2. Special Tools
   - a. A dial indicator and accessories.
   - b. Bearing race removal tool and shim stock. (See Figure 5.)
   - c. A cylinder block spring decompression tool. (See Figure 6.)
   - d. Two studs (8″ long × 0.437-14 dia./C1-2A thd. class).
   - e. Shaft seal assembly tool. (See Figure 7.)
   - f. Force indicator tool that will read up to 25 lb.
   - g. Bearing race installation tool. (See Figure 8.)
   - h. In addition to the above tools, an arbor press is required to assemble bearings. A chain fall is also recommended to handle the pump.
   - i. A piece of shim stock or teflon material (8″ × 3″ × .003″).

Section V - SERVICE MAINTENANCE

A. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. See Table 4.

B. CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

C. SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1.. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

D. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet M-2950-S for oil selection is available from Technical Publications, Troy, MI.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your sales representative.

E. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to the system, it should be pumped through a 10 micron absolute filter. The use of a porta-filter transfer unit (PFTU) to filter clean fluid into the system is recommended. For further information on the porta-filter transfer unit, obtain service drawing I-3952-S.

It is important that the fluid be kept clean and free from any substance that may cause improper operation or wear to the pump and other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from entering the system.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. PRODUCT LIFE

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

the pump outlet and the actuator load is less than ΔP setting, the pump will deliver maximum flow. When the ΔP exceeds the setting of the load sensing portion of the control, the load sensing spool will move and meter fluid to the control piston area within the pump and decrease pump displacement (flow). As a result, only the required amount of fluid is delivered through the load sensing directional valve to the load.

If the orifice within the load sensing directional valve is significantly reduced or closed, pump outlet pressure will increase to the pressure setting of the compensator. At this condition, the pressure compensator portion of the control overrides the load sensing portion of the control, and moves the yoke to achieve minimum pump displacement at maximum pressure. During this phase, a power loss is created because no work is being performed. To reduce such a power loss, the pump will enter a *standby* condition (minimum displacement @ minimum pressure). The *standby* condition is accomplished through the design of the load sensing directional valve. The load sensing valve meters trapped fluid within the load circuit through its internal valving system to tank. Thus, horsepower requirements to the load are reduced and system efficiency is increased.

NOTE
The earlier PVE62*-**-10 design pump uses a different 'CV' control. This control is shown in control manual M-2231-S.

Section IV – INSTALLATION

A. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION
Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings.

1. Direct Mounting – A pilot on the pump mounting flange assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without engineering approval.

C. SHAFT ROTATION

CAUTION
Never drive a pump in the wrong direction of rotation. Seizure will result and cause expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with clean solvent to remove loose particles.

NOTE
For information on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube.

During operation, load or system pressure is continually fed to the bias piston. The function of the bias piston is to maintain the yoke at a full pump displacement position. Load or system pressure is also fed to the compensator spool chamber within the control. Pressure within the compensator spool chamber acts upon the spring force of the compensator spring.

When load or system pressure is below the pressure setting of the compensator spring, the compensator spool remains offset and the pump continues to operate at full displacement. When load or system pressure approaches the compensator pressure setting, the compensator spool will start to move and overcome the compensator spring force. Fluid will then meter into the control piston area. Since the control piston area is twice that of the bias piston, the control piston pushes the yoke towards minimum pump displacement. The compensator control continues to meter fluid to the control piston, adjusting the pump displacement, and pumping only enough fluid to satisfy the load demand while holding the system at a constant pressure.

When load or system pressure exceeds the compensator setting, the compensator spool shifts towards the spring chamber area. A maximum amount of fluid is then metered to the control piston area, causing the yoke to shift to minimum pump displacement.

When system pressure decreases below the compensator pressure setting, the compensator spool returns to its original position and the yoke returns to maintain maximum pump displacement.

2. 'CV' Control (PVE27/35/47/62) – This control combines the standard 'C' pressure compensator feature with a load sensing feature. The purpose of the 'CV' control is to provide lower horsepower requirements to the load. The load sensing portion of the control functions at pressures below the compensator setting in order to provide constant flow characteristics to the load. Operation of the load sensing control is such that when pressure rises across the load, the load sensing portion of the control adjusts pump outlet flow to provide a constant flow of fluid through the spool orifice within a load sensing type directional valve.

NOTE

In a load sensing system, the load pressure signal must be generated through a special load sensing type directional valve to the CV control. In a multiple spool load sensing valve, the internal logic must be fed through the highest pressure signal to the CV control. For further information on load sensing valves, contact your nearest Vickers sales engineering office. Refer to Figure 4 for the following discussion.

Assume an actuator load pressure is gradually increasing and the pump outlet pressure is below the pressure setting of the compensator. As actuator load pressure increases, the load sensing portion of the control senses a differential pressure (ΔP) between the pump outlet and actuator load. As long as the ΔP between

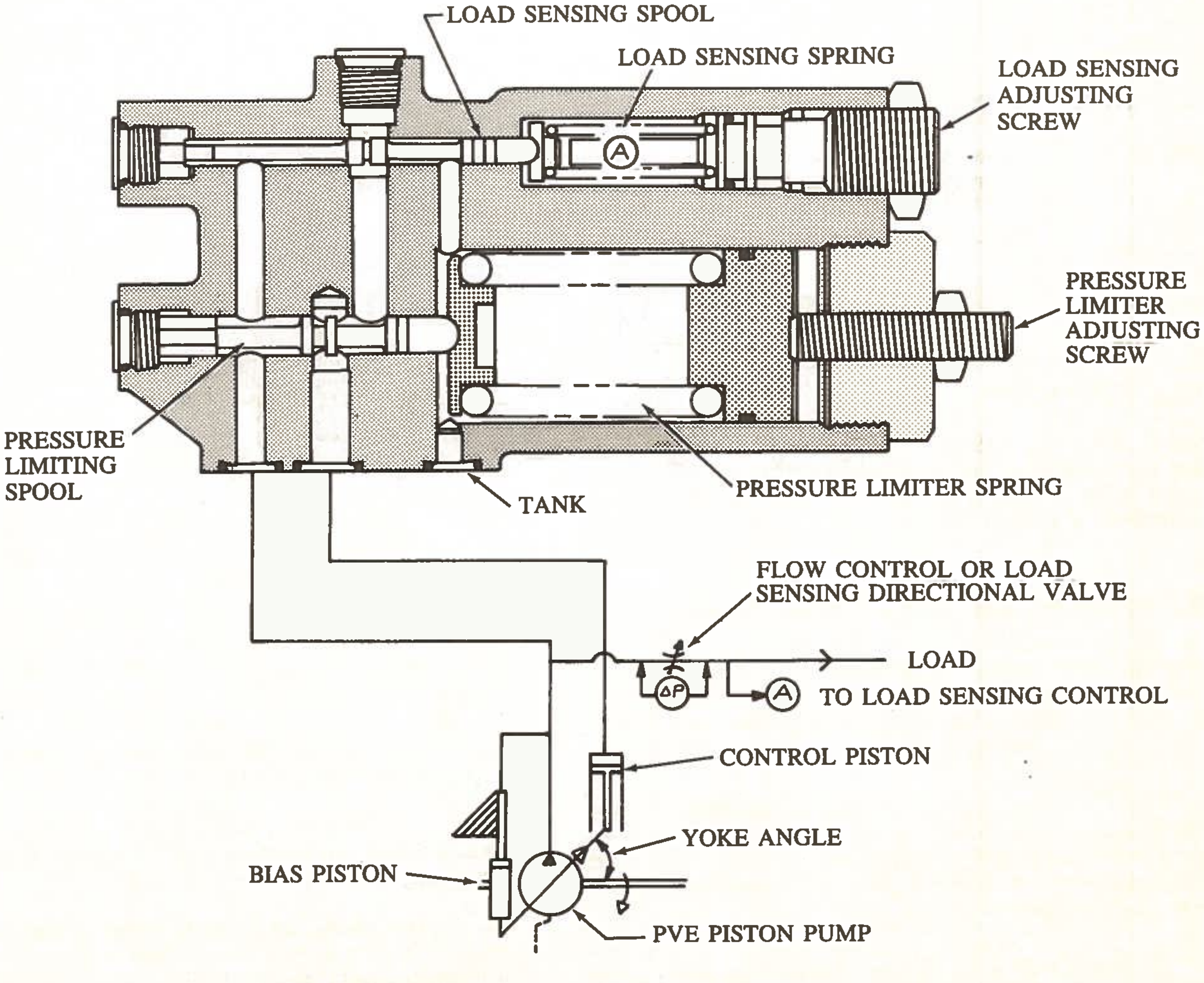


Figure 4. CV Control System (PVE27/35/47/62)

Section III – PRINCIPLES OF OPERATION

A. BASIC PUMP OPERATION

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate. See Figure 2. The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted valve plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

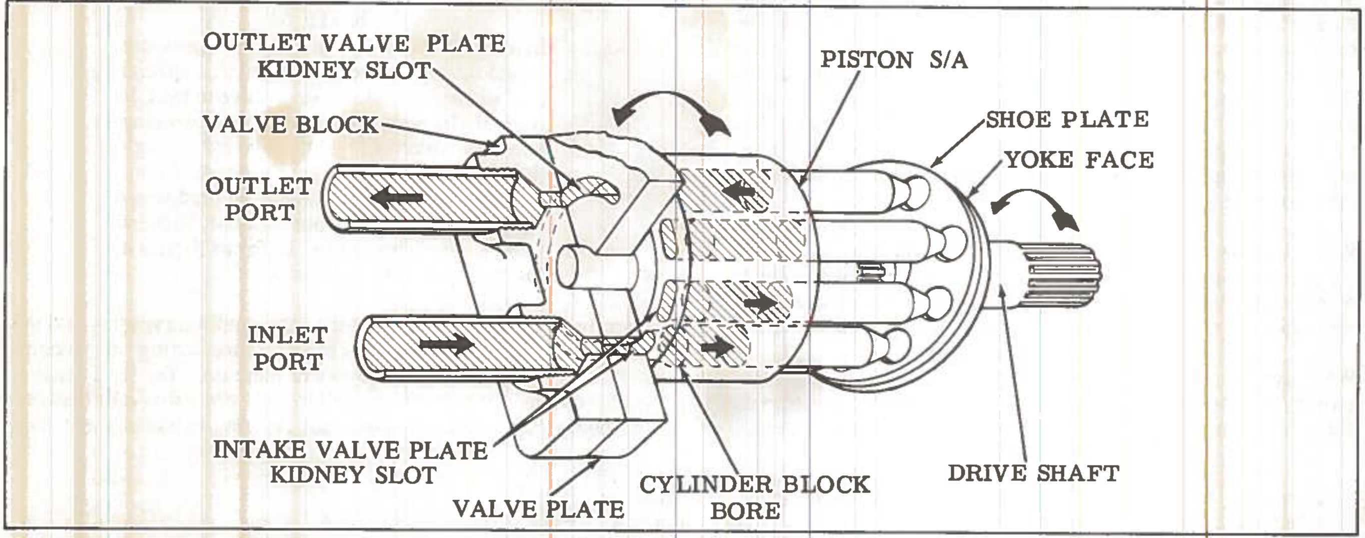


Figure 2. Basic Pump Operation

B. CONTROL OPERATION

1. 'C' Compensator Control – The standard 'C' compensator control is an internally pilot operated, spring offset, 3-way valve. Its purpose is to limit system pressure to some desired level by varying pump displacement. This control only provides the flow required to satisfy the load demand, while maintaining a constant preset pressure. Refer to Figure 3 for the following discussion.

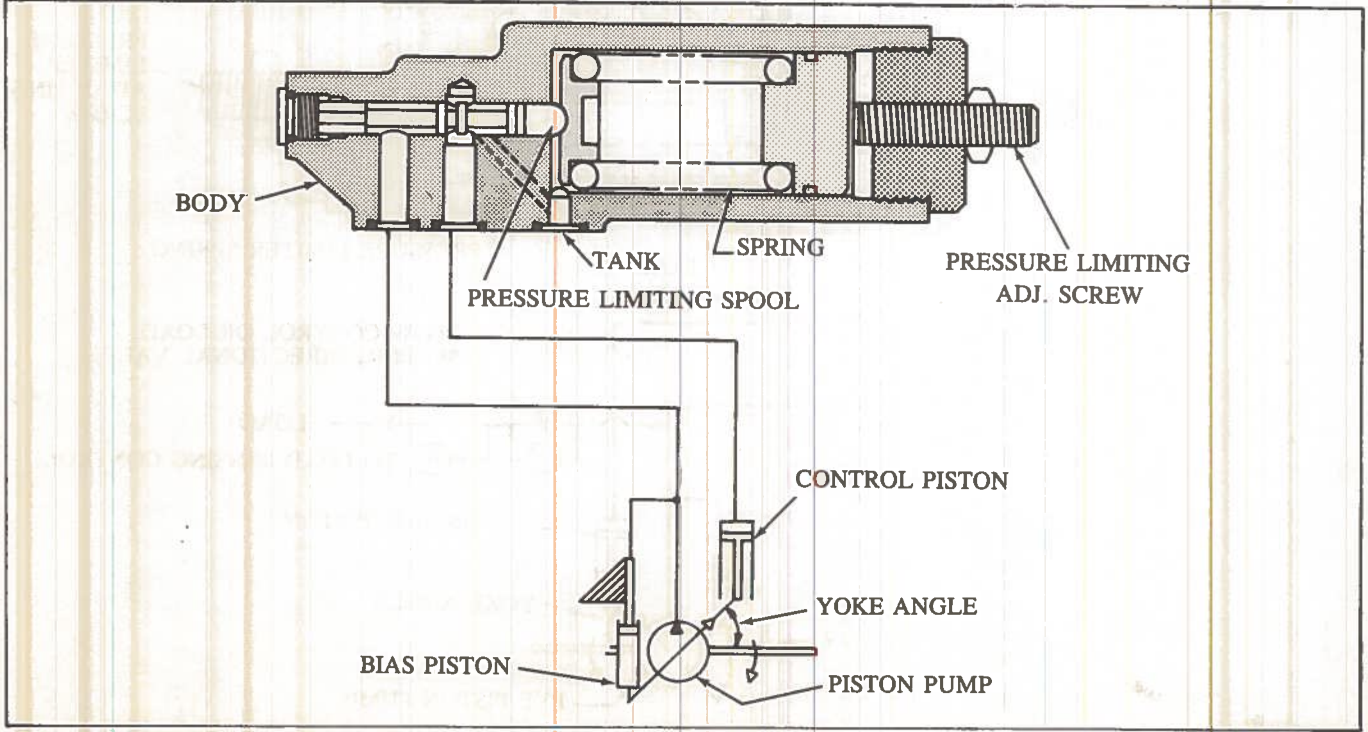


Figure 3. PVE27/35/47/62 Pressure Compensated
'C' Control System

Section II – DESCRIPTION

A. BASIC PUMP

Figure 1 describes the basic construction of a PVE series piston pump. Major parts include the drive shaft, housing, yoke, rotating group, valve plate, control piston, bias piston, valve block, and compensator control. The rotating group consists of nine pistons, a shoe plate, a swash plate, and a cylinder block.

B. PUMP CONTROLS

Two types of pump controls are available. One type is the standard 'C' compensator control that limits pump outlet pressure to a desired level. The other type of control is the 'CV' pressure limiter/load sensing control. This control limits pump outlet pressure and also regulates pump displacement to match load requirements. Control types are shown in Figures 3 and 4.

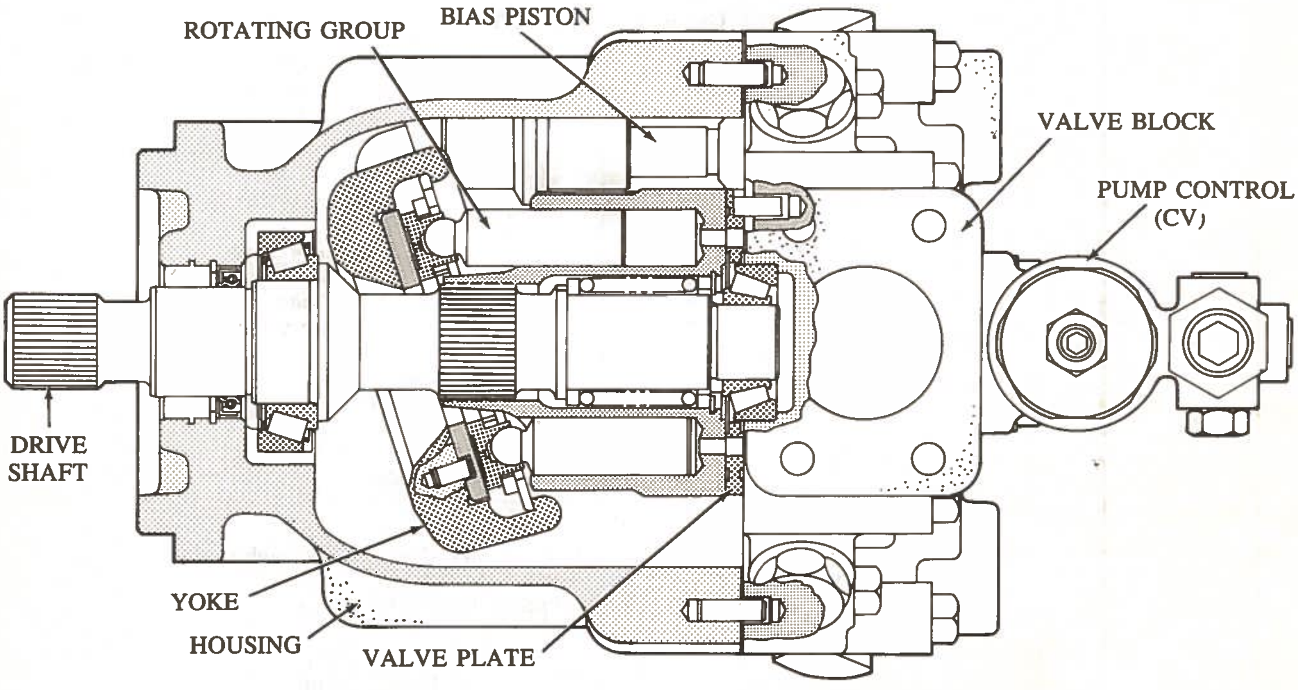


Figure 1. PVE Basic Description

Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes basic operating characteristics and provides service and overhaul information for PVE 27/35/47/62 series piston pumps. The information contained herein pertains to the latest design series as shown in the model code breakdown in Table 1.

B. RELATED PUBLICATIONS

Service part numbers and installation dimensions are not included in this manual. The service parts drawings that pertain to the PVE series pumps are listed in Table 2. These drawings are available from any sales engineering office.

C. MODEL CODE DESCRIPTION

Each pump is identified by a model code description number that is stamped on the pump's nameplate (i.e. PVE27L-680752). The model code is divided into two parts. The first part (PVE27L) identifies the basic type of pump, the flow rating, and the input shaft rotation. The second part (680752) is the pump assembly number. The assembly number identifies other variations within the pump. These variations include the type of input shaft, port configuration, pump design, type of control, control design, and special option features. Service inquiries should always include the complete model code number.

MODEL CODE BREAKDOWN

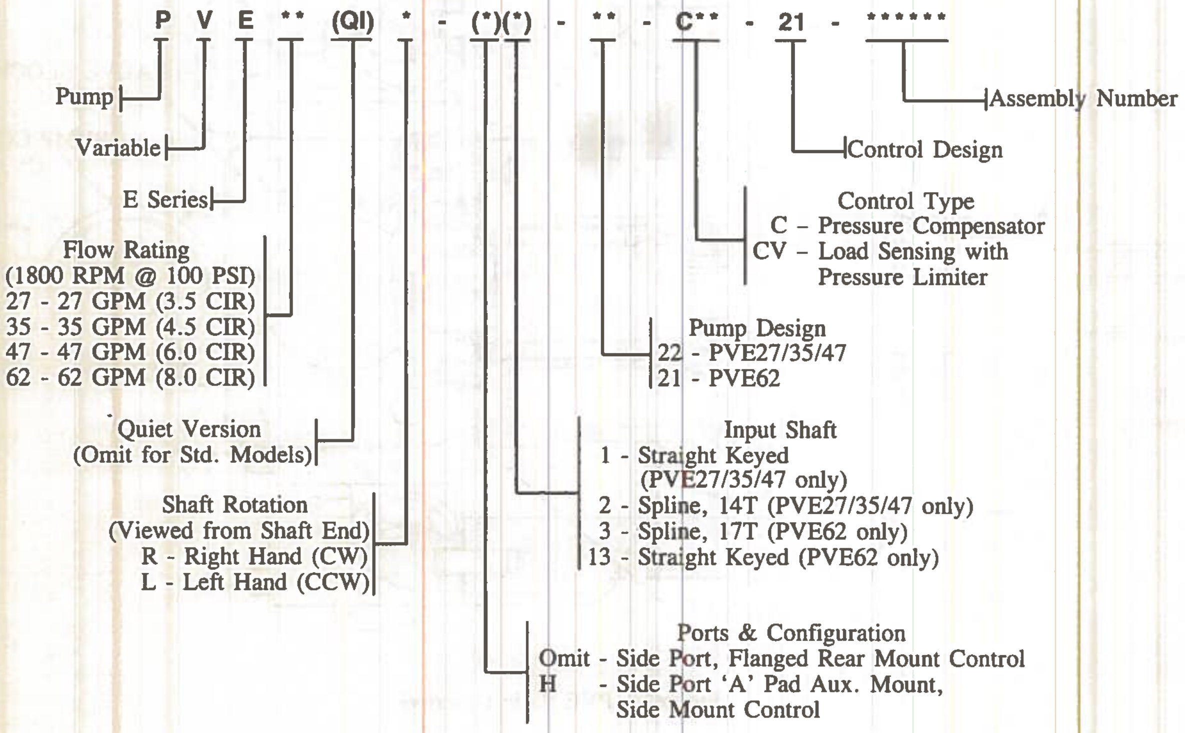


Table 1. Model Code Breakdown

Model	Service Parts Drawing
PVE27*-**-22-C**-21	M-2246-S
PVE35*-**-22-C**-21	M-2247-S
PVE47*-**-22-C**-21	M-2248-S
PVE62*-**-21-C**-21	M-2249-S

Table 2. Related Publications

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4

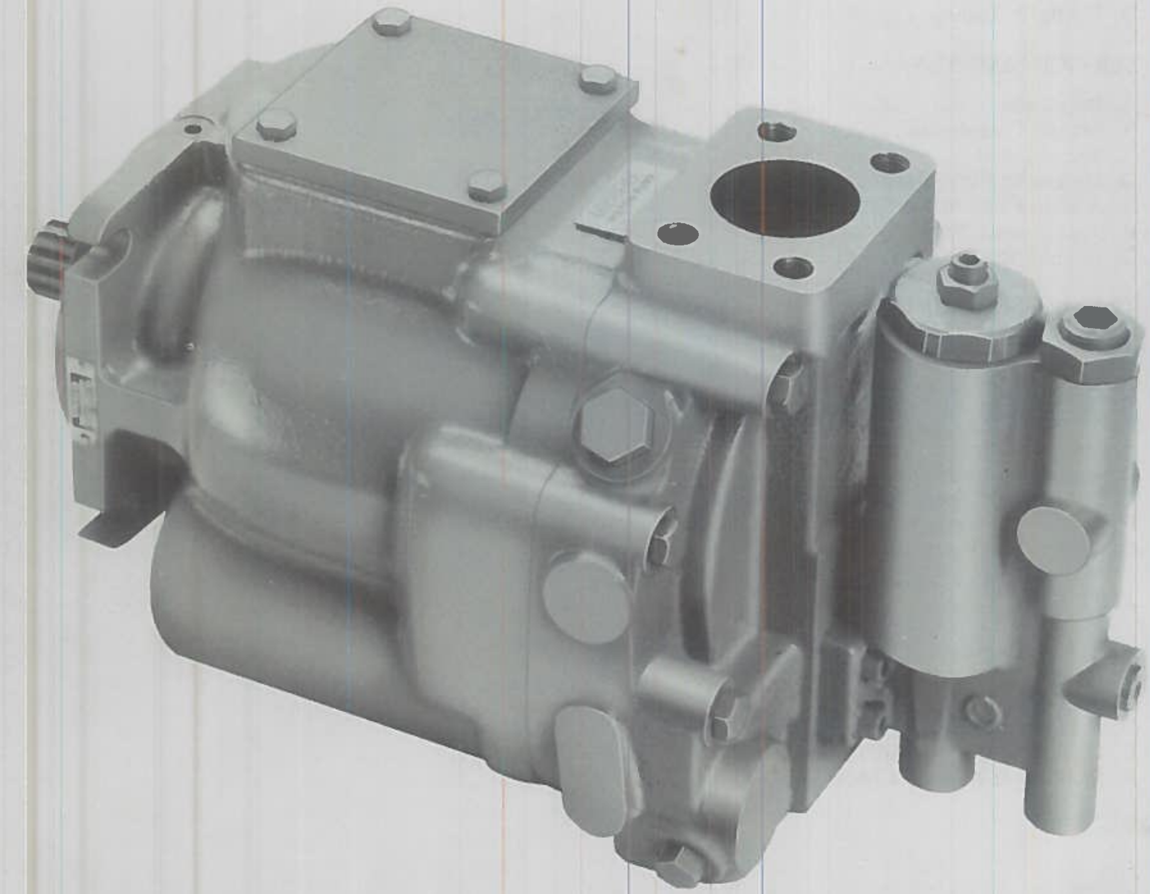
VICKERS®
A TRINOVA COMPANY

Overhaul Manual

Heavy Duty
Piston
Pump

PVE27
PVE35
PVE47
PVE62

65



Vickers, Incorporated
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M-2240-S

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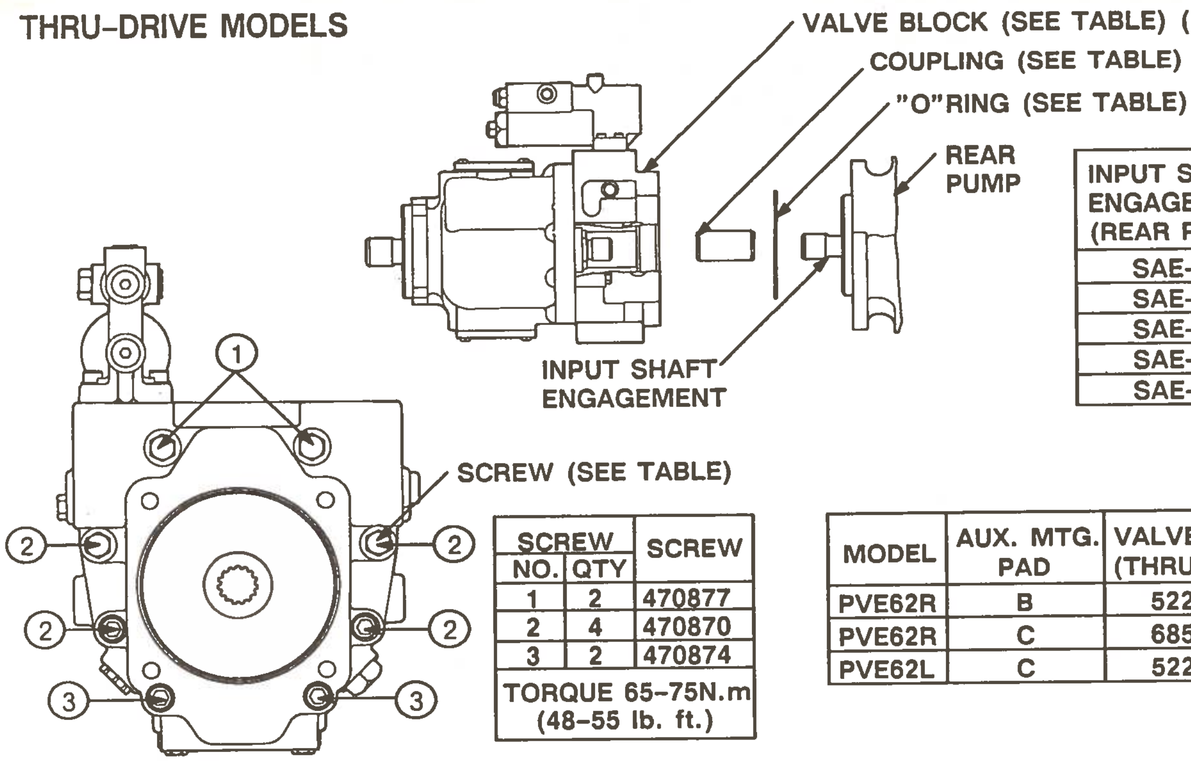
THRU-DRIVE MODELS



INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	430359
SAE-B	430360
SAE-BB	429368
SAE-C	429369
SAE-CC	682898

SCREW		SCREW
NO.	QTY	
1	2	470877
2	4	470870
3	2	470874
TORQUE 65-75N.m (48-55 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK (THRU-DRIVE)	"O"RING
PVE62R	B	522293	401525
PVE62R	C	685415	353264
PVE62L	C	522155	

MODEL CODE BREAKDOWN

P V E 62 (QI) * - * * (M) (D) - 21 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

62 - 62 GPM @ 1800 RPM (8.0 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

3 - SPLINED
13 - STRAIGHT KEYED
16 - STRAIGHT KEYED

9 PORT DESIGNATION

BLANK - 4 BOLT FLANGE (INCH)
M - METRIC

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

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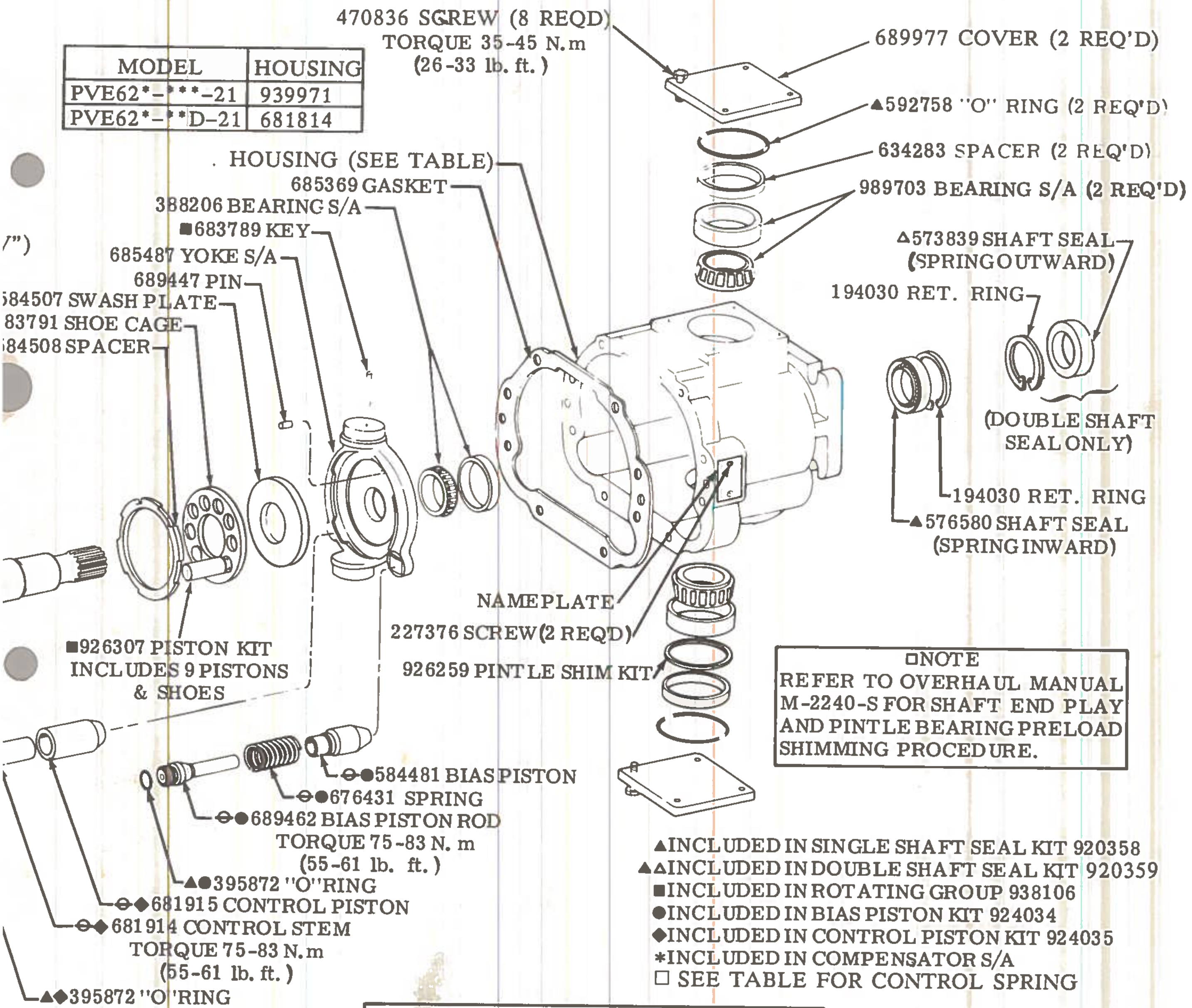
PVE62QI*-**-(M)(D)-21-C(*)V-21

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)



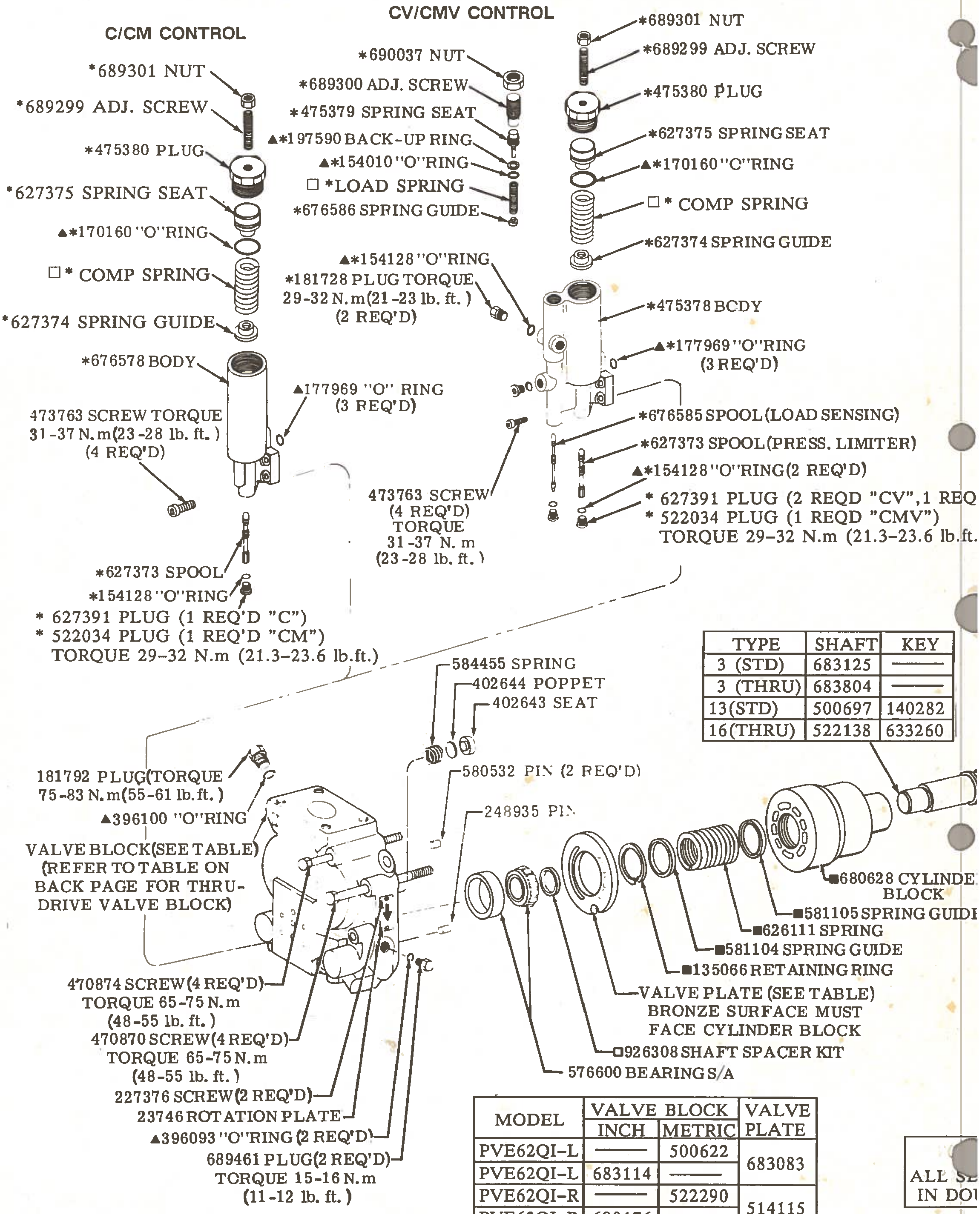
MODEL	HOUSING
PVE62*-***-21	939971
PVE62*-**D-21	681814

☐NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

▲INCLUDED IN SINGLE SHAFT SEAL KIT 920358
▲ΔINCLUDED IN DOUBLE SHAFT SEAL KIT 920359
■INCLUDED IN ROTATING GROUP 938106
●INCLUDED IN BIAS PISTON KIT 924034
◆INCLUDED IN CONTROL PISTON KIT 924035
*INCLUDED IN COMPENSATOR S/A
☐ SEE TABLE FOR CONTROL SPRING

TE
KKED ▲ INCLUDED
AFT SEAL KIT.

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.



TYPE	SHAFT	KEY
3 (STD)	683125	———
3 (THRU)	683804	———
13(STD)	500697	140282
16(THRU)	522138	633260

MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE62QI-L	———	500622	683083
PVE62QI-L	683114	———	
PVE62QI-R	———	522290	514115
PVE62QI-R	690176	———	

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Service Parts Information

HEAVY DUTY PISTON PUMP STANDARD/ THRU DRIVE

PVE62QI*-**-(M)(D)-21-C(*)V-21

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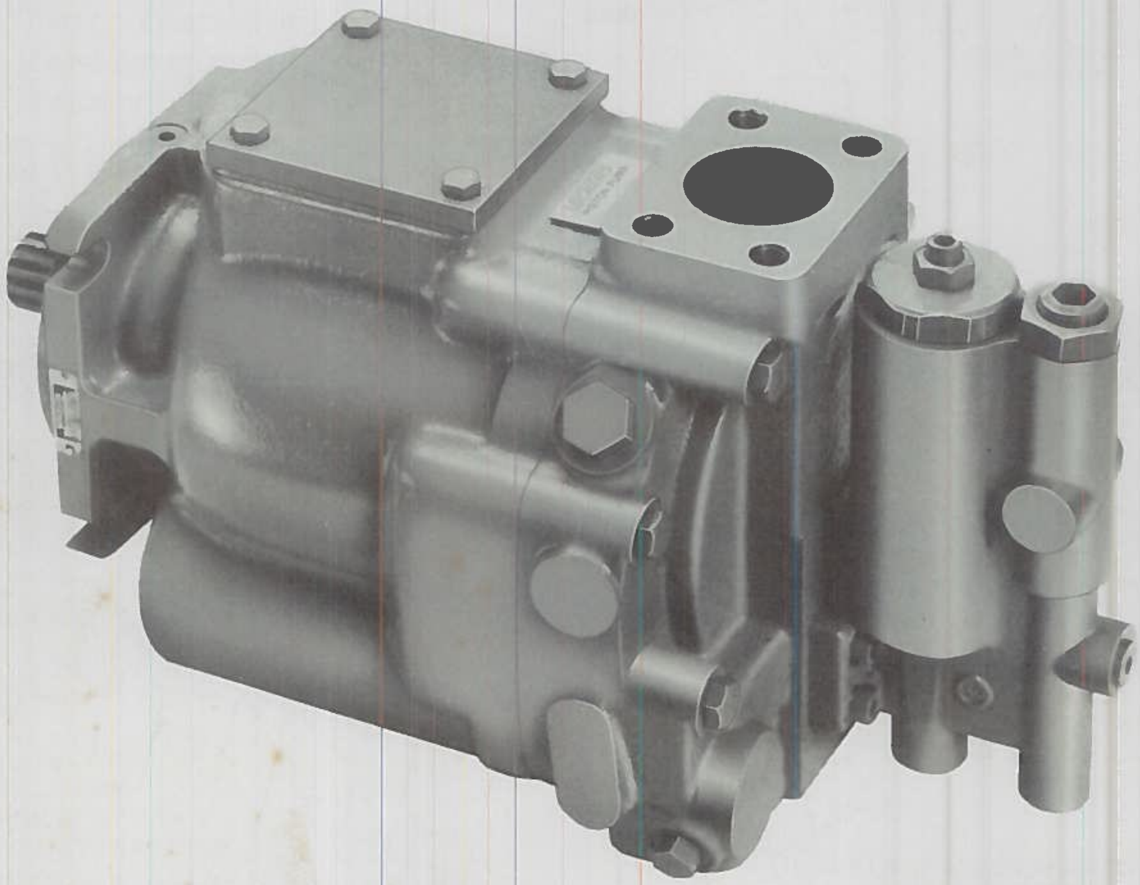

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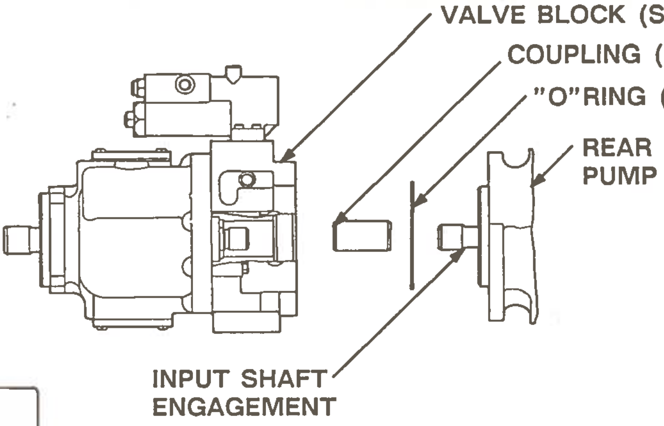
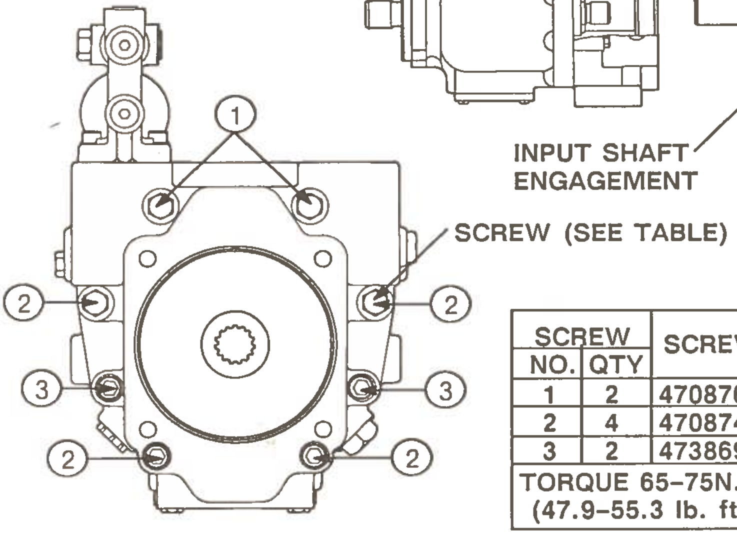
THRU-DRIVE MODELS





INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	989141
SAE-B	989153
SAE-BB	989167
SAE-C	989154
SAE-CC	685537

SCREW NO.	SCREW QTY	SCREW
1	2	470876
2	4	470874
3	2	473869
TORQUE 65-75N.m (47.9-55.3 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK INCH	VALVE BLOCK METRIC	"O"RING
PVE35L	A	939843	939966	576601
PVE35R	A	939886	———	
PVE35L	B	939881	———	401525
PVE35R	B	939844	939967	
PVE35L	C	939883	———	353264
PVE35R	C	500793	500679	

MODEL CODE BREAKDOWN

P V E 35(QI) * - * * (M) (D) - 22 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

35 - 35 GPM @ 1800 RPM (4.5 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
A - SIDE PORT 'A' PAD AUX. MOUNT, SIDE MOUNT CONTROL
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

1 - STRAIGHT KEYED
2 - SPLINED
3 - SPLINED
13 - STRAIGHT KEYED

9 PORT DESIGNATION

(4 BOLT FLANGE)
BLANK - SAE I-518
M - ISO/DIS 6162

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

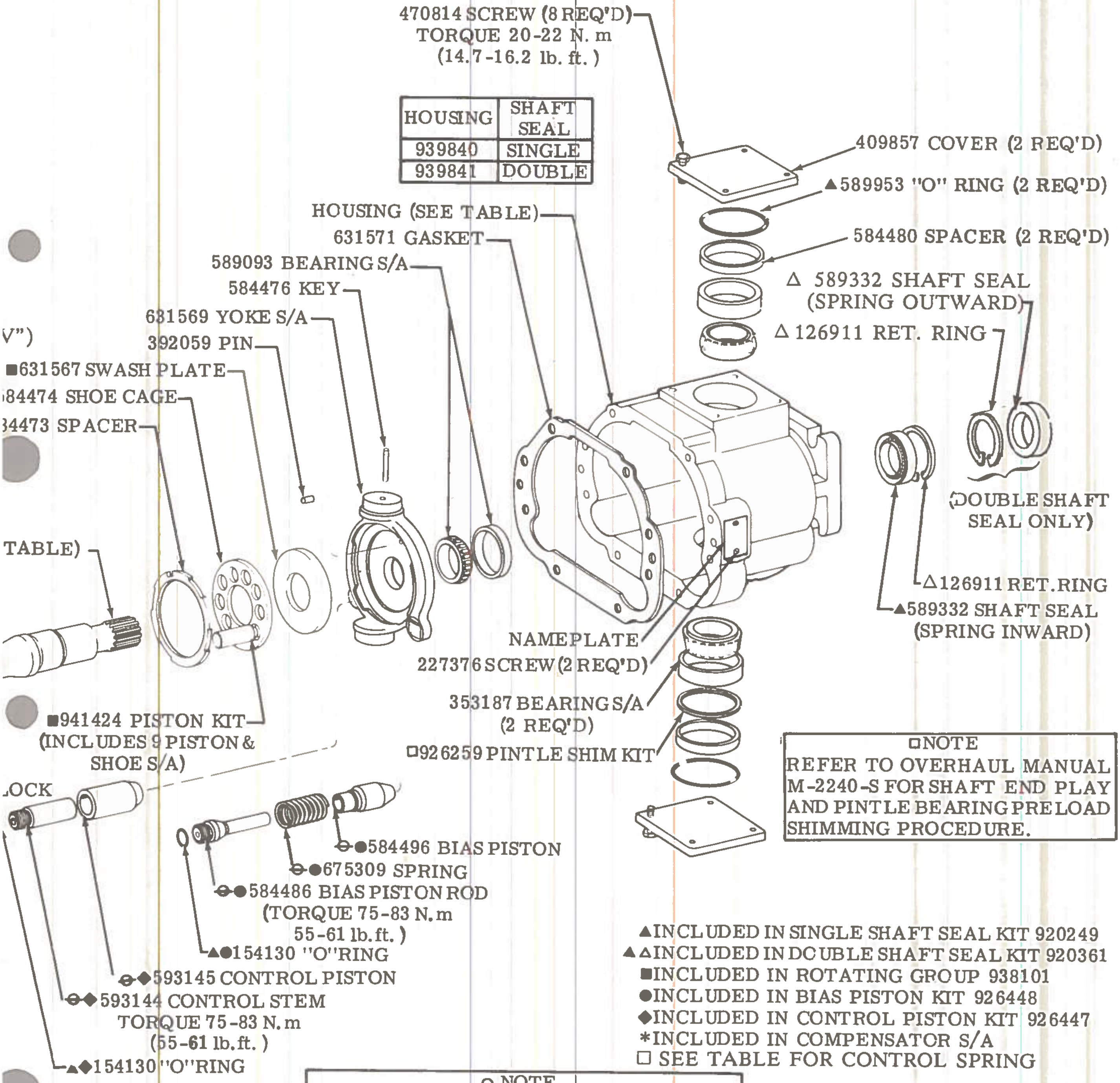
15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

Litho in U.S.

PVE35QI*-**-(M)(D)-22-C(*)V-21

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)



HOUSING	SHAFT SEAL
939840	SINGLE
939841	DOUBLE

☐NOTE
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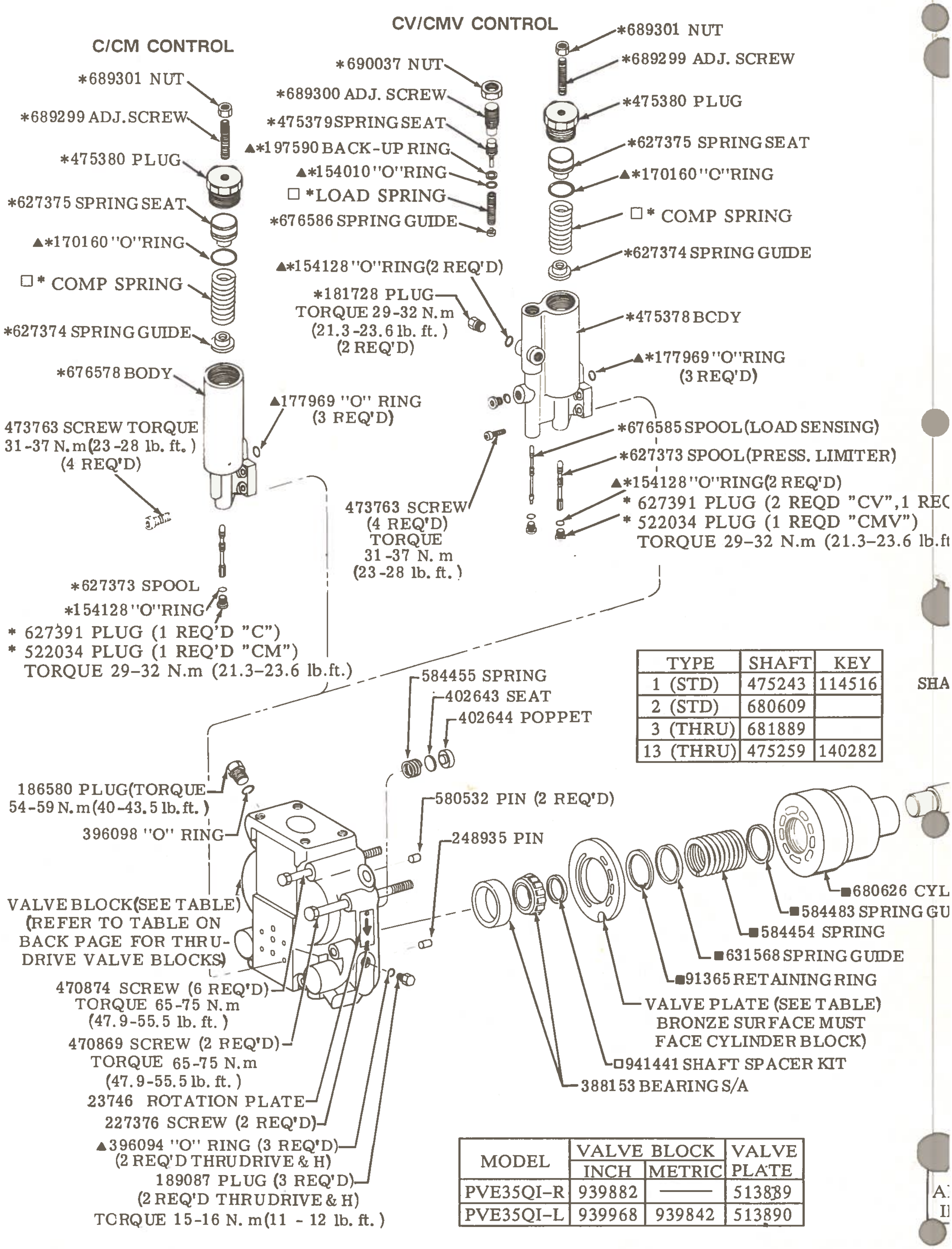
▲INCLUDED IN SINGLE SHAFT SEAL KIT 920249
▲ΔINCLUDED IN DOUBLE SHAFT SEAL KIT 920361
■INCLUDED IN ROTATING GROUP 938101
●INCLUDED IN BIAS PISTON KIT 926448
◆INCLUDED IN CONTROL PISTON KIT 926447
*INCLUDED IN COMPENSATOR S/A
☐ SEE TABLE FOR CONTROL SPRING

▲ NOTE
S MARKED ▲ INCLUDED
LE SHAFT SEAL KIT.

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.



TYPE	SHAFT	KEY
1 (STD)	475243	114516
2 (STD)	680609	
3 (THRU)	681889	
13 (THRU)	475259	140282

MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE35QI-R	939882	———	513889
PVE35QI-L	939968	939842	513890

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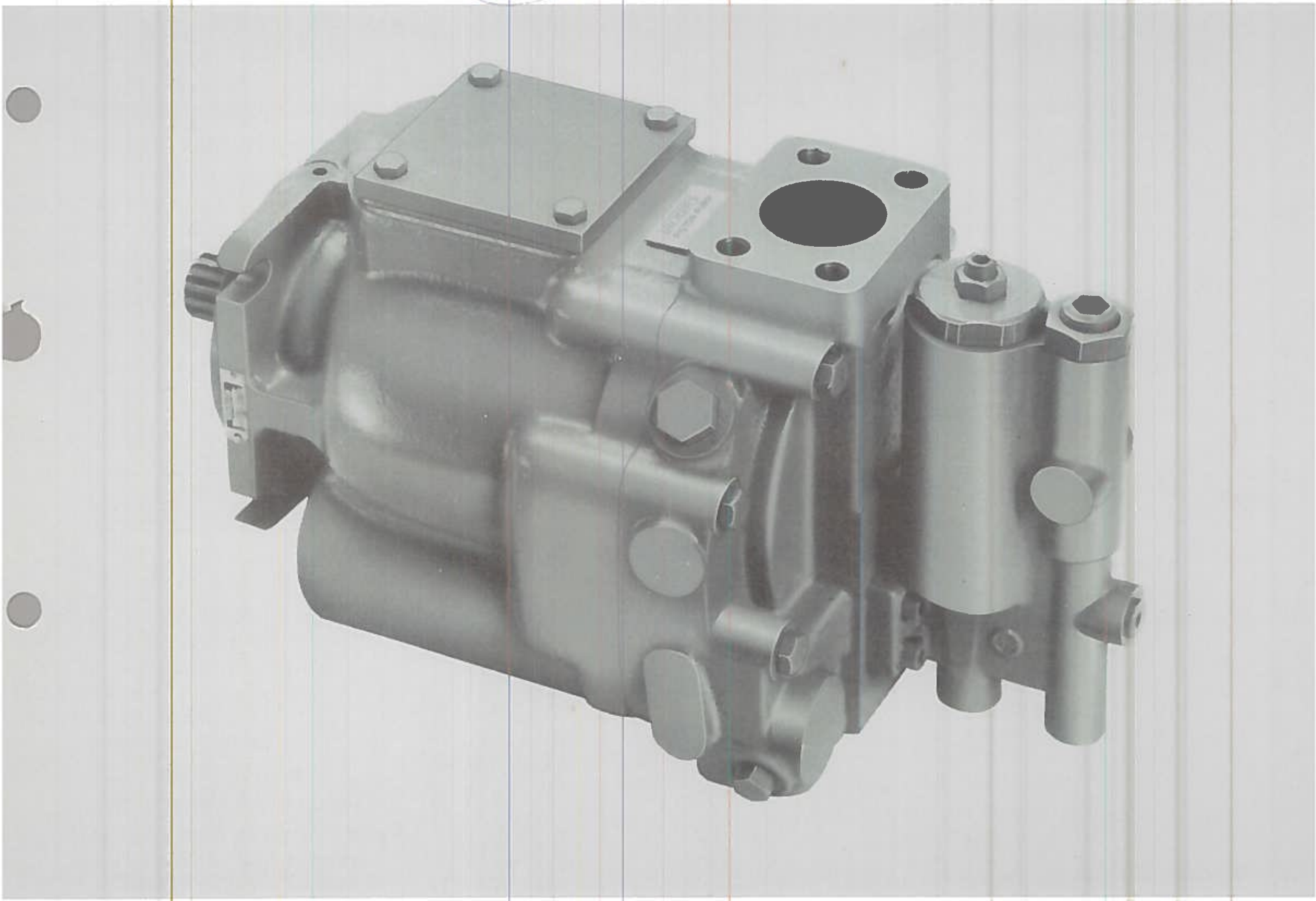
HEAVY DUTY
PISTON PUMP
STANDARD/
THRU DRIVE

PVE35QI*-**-(M)(D)-22-C(*)V-21

5D



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Released 8-1-88 **M-2236-S**

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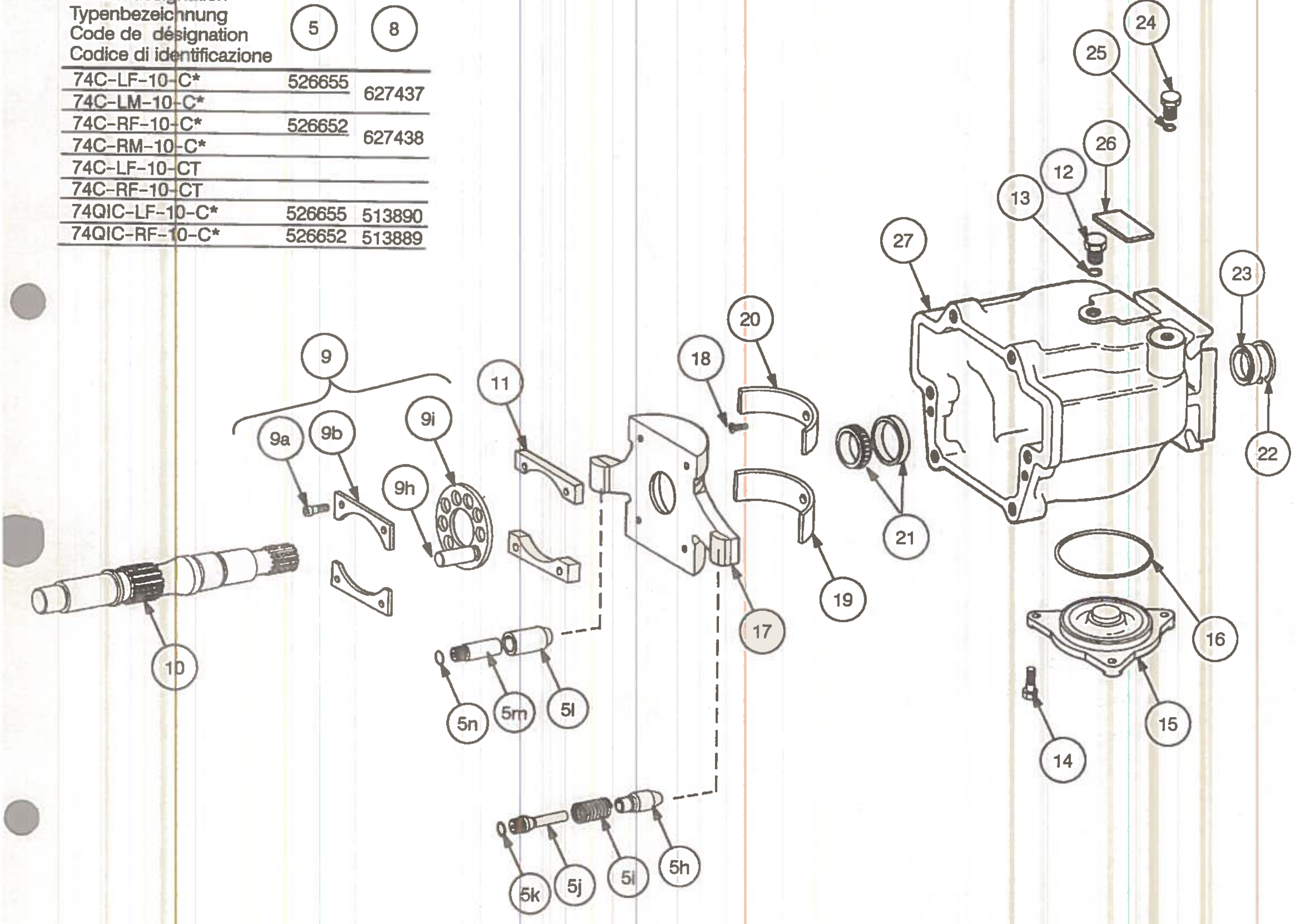
Model designation Typenbezeichnung Code de désignation Codice di identificazione	②	2f	2m	2q	2r	Pressure range Druckbereich Plage de tarage Pressione di taratura
74C-**-10-C	02-125160	857681	-------	627391	154128	70-250 Bar
74C-**-10-CM	02-125162	857675	-------	627391	154128	35-140 Bar
74C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	⑤	⑧
74C-LF-10-C*	526655	627437
74C-LM-10-C*		
74C-RF-10-C*	526652	627438
74C-RM-10-C*		
74C-LF-10-CT		
74C-RF-10-CT		
74QIC-LF-10-C*	526655	513890
74QIC-RF-10-C*	526652	513889



⊞ NOTE

Use shims (item 7) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

⊞ HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 7 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

⊞ REMARQUE

Monter les cales d'épaisseur (rep. 7) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

⊞ NOTA

Usare spessori (particolare 7) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

⊞ NOTE

Right hand rotation shown. For left hand rotation install control rod (5m) & control piston (5l) in valve block port #2 & bias rod (5j), bias piston (5h), & spring (5i) in valve block port #1.

⊞ HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (5m) & Steuerkolben (5l) in Ventilblock Anschluß #2 und Haltestange (5j), Haltekolben (5h) & (5l) in Ventilblock Anschluß #1 motieren.

⊞ REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (5m) et le piston (5l) de commande dans l'orifice n° 2, et d'autre part la tige (5j) et le piston (5h) de maintien ainsi que le ressort (5i) dans l'orifice n° 1.

⊞ NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (5m) e il pistone di controllo (5l) nell'attacco del blocco valvola n.2; l'asta di reazione (5j), il pistone di reazione (5h) e la molla (5i) nell'attacco del blocco valvola n.1.

tem os. ep. os.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
	473763 (4)		Screw	Schraube	Vis	Vite
	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
a	855564 (2)		Nut	Mutter	Ecrou	Dado
b	857677		Plug	Stopfen	Bouchon	Tappo
c	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
d	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
e	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
f	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
g	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
h	857676	◇	Plug	Stopfen	Bouchon	Tappo
i	154130	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
j	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
k	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
l	857679	◇	Pin	Stift	Goupille de positionnement	Spina
m	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
n	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
o	181728	◇	Plug	Stopfen	Bouchon	Tappo
p	154128	▲	O-ring	O-Ring	Joint torique	O-Ring
q	See table	◇	Plug	Stopfen	Bouchon	Tappo
r	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
s	857672		Pressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
t	857673	◇	Load sense spool	”Load sensing”-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
u	177969 (3)		O-ring	O-Ring	Joint torique	O-Ring
v	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
	473483 (4)		Screw	Schraube	Vis	Vite
	473478 (2)		Screw	Schraube	Vis	Vite
	See table	*	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
a	689461 (2)		Plug	Stopfen	Bouchon	Tappo
b	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
c	402643		Seat	Sitz	Siège	Sede
d	402644		Poppet	Kegel	Clapet	Otturatore
e	584455		Spring	Feder	Ressort	Molla
f	248935		Pin	Stift	Goupille de positionnement	Spina
g	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
h	690816	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
i	526667	▦	Spring	Feder	Ressort	Molla
j	690806	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
k	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
l	690804	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
m	690805	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
n	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
o	388153	■	Bearing	Lager	Roulement	Cuscinetto
	526631	▲	Gasket	Dichtung	Joint	Guarnizione
	941441	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
	See table		Valve plate	Ventilppatte	Glace de distribution	Piastra di distribuzione
	877421	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
a	473741 (4)	●	Screw	Schraube	Vis	Vite
b	690218 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
c	91365	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
d	631568	●	Spring guide	Federführung	Guide de ressort	Guida della molla
e	584454	●	Spring	Feder	Ressort	Molla
f	584483	●	Spring guide	Federführung	Guide de ressort	Guida della molla
g	680626	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
h	941424	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
	584474	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
0	692567		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	513864		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	864343		Shaft (type 3)	Welle (Typ 3)	Arbre (type 3)	Albero (tipo 3)
	864344		Shaft (type 13)	Welle (Typ 13)	Arbre (type 13)	Albero (tipo 13)
	883082		Shaft (type N)	Welle (Typ N)	Arbre (N)	Albero (tipo N)
0a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
	472287		Key (type N)	Paßfeder (Typ N)	Clavette (type N)	Chiavetta (tipo N)
1	526639 (2)		Spacer	Distanzstück	Entretoise	Distanziale
2	513602		Plug	Stopfen	Bouchon	Tappo
3	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
4	470793 (3)		Screw	Schraube	Vis	Vite
5	526637		Cover	Deckel	Couvercle	Coperchio
6	411575	▲	O-ring	O-Ring	Joint torique	O-Ring
7	526651		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
8	690339	■	Screw	Schraube	Vis	Vite
9	513927	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
0	513926	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
1	589093	■	Bearing	Lager	Roulement	Cuscinetto
2	126911		Retaining ring	Sprengring	Circlips	Anello di arresto
3	589332		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
4	186580		Plug	Stopfen	Bouchon	Tappo
5	396098	▲	O-ring	O-Ring	Joint torique	O-Ring
6	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
7	526649	*	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizione)
	883085	*	Housing (metric single seal)	Gehäuse (Einzeldichtung metrisch)	Carter (joint métrique simple)	Corpo (con singola guarnizione metrica)

✱ Not available for sale

▲ Available in single shaft seal kit 02-102261
Equivalent double shaft seal kit 02-102262

● Available in rotating group kit 877421

■ Available in bearing kit 877424

◇ Omit on C control S/A

▦ See assembly instructions

⊞ See assembly note

Item Pos. Rep. Pos.	Torque values Anziehmomente Couples de serrage Coppia di serraggio
1	31-37 Nm. (23-28 lb.ft.)
2a	8-10 Nm. (6-7.3 lb.ft.
2b	97-106 Nm. (71-78 lb.ft.)
2h	75-83 Nm. (55-60 lb.ft.)
2o	29-32 Nm. (21-24 lb.ft.)
2q	29-32 Nm. (21-24 lb.ft.)
3	85-103 Nm. (63-76 lb.ft.)
4	85-103 Nm. (63-76 lb.ft.)
5a	12.7-13Nm. (8.9-9.5 lb.ft.)
5j	75-83 Nm. (55-60 lb.ft.)
5m	75-83 Nm. (55-60 lb.ft.)
9a	13-15 Nm. (9-11 lb.ft.)
12	97-106 Nm. (71-78 lb.ft.)
14	7-9 Nm. (5-6.6 lb.ft.)
18	3.6-4.4 Nm. (2.3-3 lb.ft.)
24	54-59 Nm. (40-43 lb.ft.)

All repairs must be made in clean conditions and by clean practices compatible with subsequent efficient operations of the unit in systems having filtration to 25µm or finer.

✱ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102261
Erhältlich als Doppelwellen Dichtungssatz 02-102262

● Erhältlich als Rotationsbau gruppe 877421.

■ Erhältlich als Lagersatz 877424

◇ Erhältlich bei Reglertyp C

▦ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

Bei Inbetriebnahme und Betrieb dieser Präzisionsgeräte ist die Filterung der Druckflüssigkeit - auf 25 µm oder feiner - Voraussetzung für optimale Wirtschaftlichkeit und Lebensdauer.

✱ Non disponible séparément.

▲ Compris dans la pochette 02-102261 (joint d ' arbre simple)
Pochette équivalente 02-102262 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877421.

■ Compris dans le kit de roulement 877424.

◇ Omis sur le sous-ensemble de commande C.

▦ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

Toutes les réparations doivent être faites dans des conditions saines et par des moyens propres compatibles avec le fonctionnement correct de l'appareil dans un circuit filtré à 25 microns ou mieux.

✱ Non in vendita singolarmente

▲ Disponibile nella serie a singola guarnizione d ' albero 02-102261
Equivalente alla serie a doppia guarnizione 02-102262

● Disponibile nel kit per il gruppo rotante 877421

■ Disponibile nel kit del cuscinetto 877424

◇ Omettere sul controllo C S/A

▦ Vedere istruzioni per il montaggio

⊞ Vedere nota per il montaggio

Le riparazioni devono essere effettuate in ambiente pulito e in ogni caso in condizioni tali da consentirne un regolare funzionamento in sistemi idraulici con grado di filtrazione di 25 o più fine.

6 Configuration

Blank – Non thru drive
A – SAE "A" pad thru drive
B – SAE "B" pad thru drive
C – SAE "C" pad thru drive

8 Shaft

1 – SAE C Straight keyed
2 – SAE C Splined
3 – SAE CC Splined
13 – SAE CC Straight keyed
N – ISO 3019-2 Straight keyed

6 Bauart

Leer – Ohne durchg. Welle
A – SAE "A" Befestigung für durchg. Welle
B – SAE "B" Befestigung für durchg. Welle
C – SAE "C" Befestigung für durchg. Welle

8 Welle

1 – SAE "C" zylind. mit Paßfeder
2 – SAE "C" verzahnte Welle
3 – SAE "CC" verzahnte Welle
13 – SAE "CC" zylind. mit Paßfeder
N – ISO 3019-2 zylind. mit Paßfeder

6 Exécution

Omis – sans entraînement traversant
A – entraînement traversant avec plan de pose SAE A
B – entraînement traversant avec plan de pose SAE B
C – entraînement traversant avec plan de pose SAE C

8 Bout d'arbre

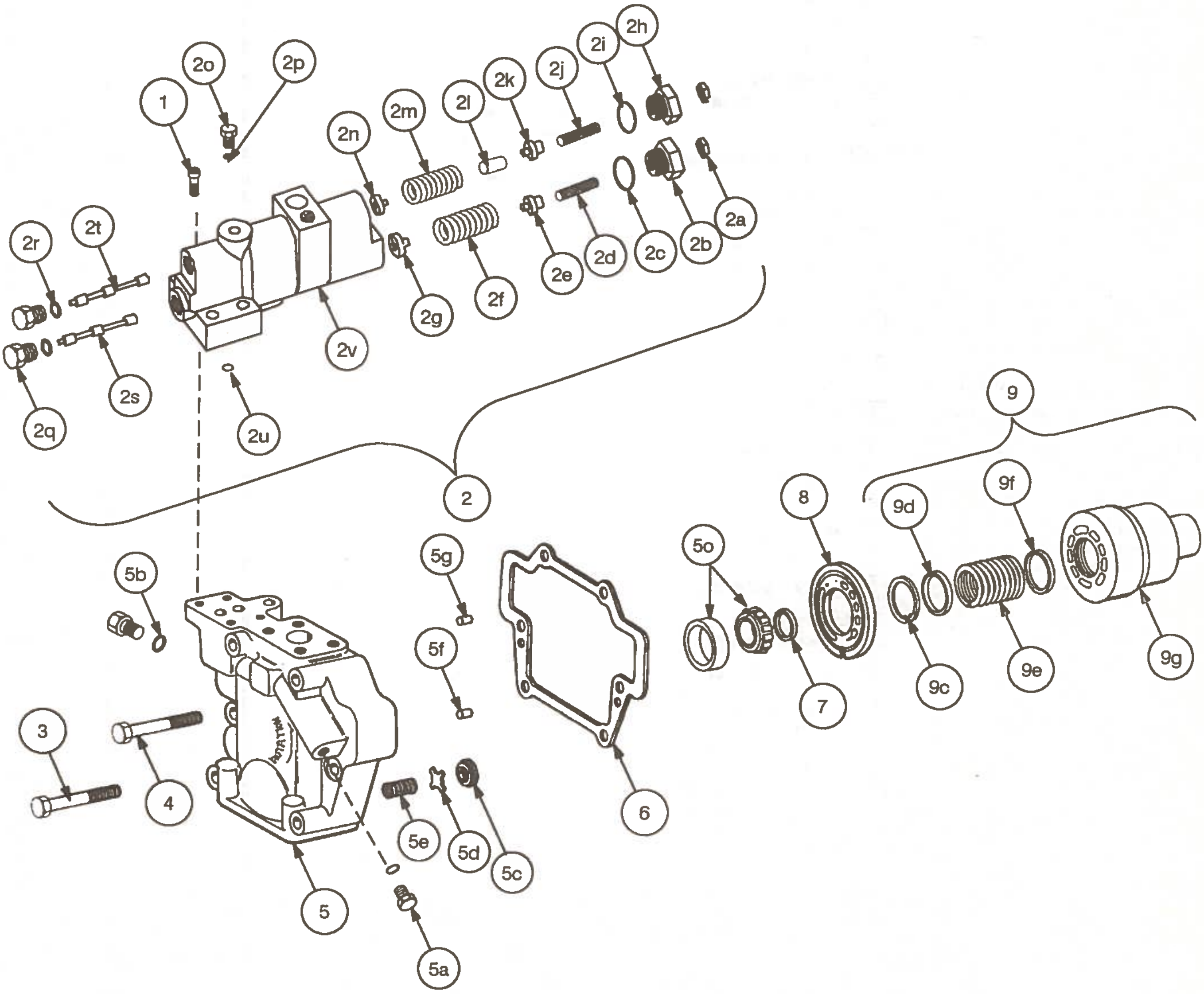
1 – cylindrique claveté SAE C
2 – cannelé SAE C
3 – cannelé SAE CC
13 – cylindrique claveté SAE CC
N – ISO 3019-2 cylindrique claveté

6 Configurazione

Vuoto – Albero non passante
A – Albero passante con flangia SAE "A"
B – Albero passante con flangia SAE "B"
C – Albero passante con flangia SAE "C"

8 Albero

1 – Cilindrico con chiavetta SAE "C"
2 – Scanalato SAE "C"
3 – Scanalato SAE "CC"
13 – Cilindrico con chiavetta SAE "CC"
N – Cilindrico con chiavetta ISO 3019-2



11 Control Options

C – Pressure Compensator STD.
CM – Pressure Compensator
CV** – Pressure Compensator-with load sensing
CT**** – Pressure Compensator with torque limiter
CVT**** – Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C – Druckregler (Standard)
CM – Druckregler
CV** – Druckregler mit Load sensing
CT**** – Druckregler mit Drehmomentbegrenzer
CVT**** – Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C – compensateur de pression standard
CM – compensateur de pression
CV** – compensateur de pression "load-sensing"
CT**** – compensateur de pression avec limiteur de couple
CVT**** – compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C – Compensatore di pressione standard
CM – Compensatore di pressione
CV** – Compensatore di pressione con rilevatore di carico
CT**** – Compensatore di pressione con limitatore di coppia
CVT**** – compensatore di pressione con limitatore di coppia e rilevatore di carico

Spare parts information
Ersatzteilinformation
Fiche de pièces détachées
Bollettino parti di ricambio

VICKERS

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Piston pump
Kolbenpumpe
Pompe à pistons
Pompa a pistoni

PVH 74 (QI) C–R A F–1–S–10–C 25 VT 18–14

1 2 3 4 5 6 7 8 9 10 11 12 13 13 14

1 PVH Model Series

2 Variable Displacement

74- 74 cc/r

3 Quiet Version

Blank - Mobile version
QI - Quiet industrial

4 Mounting Flange

C - SAE "C" , 4 bolt
M - ISO-3019-2

5 Rotation
(Viewed from shaft end)

R - Clockwise rotation
L - Counterclockwise rotation

6 Configuration (see table)

7 Port Connections

F - SAE flange ports
M - Metric flange ports

8 Shaft
(see table)

9 Shaft Seal

S - Single
D - Double

10 Pump Design

11 Control Options
(see table)

12 Pressure Comp. Setting
(Tens of bar)

25 - 250 bar setting (C)
7 - 70 bar setting (CM)

13 Torque Limiter Setting
(Tens of bar)

18 - 180 bar
(Must be 30-80 % of Max. pressure compensator setting)

14 Control Design

30 - C/CV
13 - CT
14 - CVT

1 Baureihe PVH

2 Verstellbares Fördervolumen

74 - 74 cm^3/u

3 Leise Ausführung

Leer - Mobil-Version
QI - Leise Industrie-Version

4 Bfestigungsflansch

C - SAE "C" , 4 Schrauben
M - ISO-3019-2

5 Drehrichtung
(Mit Blick auf Wellenende)

R - Rechtslauf
L - Linkslauf

6 Bauart (siehe tabelle)

7 Systemanschlüsse

F - SAE Flansche
M - Metrische Flansche

8 Welle
(siehe tabelle)

9 Wellendichtung

S - Einzeldichtung
D - Doppeldichtung

10 Seriennummer Pumpe

11 Reglervausführung
(siehe tabelle)

12 Reglereinstellung
(in 10 bar stufen)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Einstellung Drehmomanbegrenzer
(in 10 bar Stufen)

18 - 180 bar
(Muß 30-80 % der max. Reglereinstellung betragen)

14 Seriennummer Regler

30 - C/CV
13 - CT
14 - CVT

1 Série PVH

2 Cylindrée variable

74 - 74 cm^3/tr

3 Version silencieuse

Omis - version mobile
QI - version industrielle silencieuse

4 Bride de montage

C - SAE C à 4 vis
M - ISO-3019-2

5 Sens de rotation
(vu du côté arbre)

R - horaire
L - anti-horaire

6 Exécution
(Voir le tableau)

7 Raccordement des orifices

F - bride SAE
M - bride métrique

8 Bout d'arbre
(Voir le tableau)

9 Joint d'arbre

S - Simple
D - Double

10 Numéro de dessin de pompe

11 Choix de commandes
(Voir le tableau)

12 Tarage du compensateur de pression
(en dizaines de bar)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Réglage du limiteur de couple
(en dizaines de bar)

18 - 180 bar
(Obligatoirement 30 à 80% du tarage maxi. de compensateur)

14 Numéro de dessin de la commande

30 - C/CV
13 - CT
14 - CVT

1 Modello serie PVH

2 Cilindrata variabile

74- 74 cc/r

3 Versione silenziosa

Vuoto - versione appl.mobile
QI - Versione silenziosa appl.industriali

4 Flangia di montaggio

C - 4 fori SAE "C"
M - ISO-3019-2

5 Rotazione
(vista dal lato albero)

R - Rotazione oraria
C - Rotazione antioraria

6 Configurazione
(vedi tabella)

7 Bocche di connessione

F - attacchi flangiati SAE
M - attacchi a flangia metriche

8 Albero
(vedi tabella)

9 Guarnizione albero

S - Singola
D - Doppia

10 Serie pompa

11 Opzioni sul controllo
(vedi tabella)

12 Taratura del compensatore di pressione
(in decine di bar)

Pressione di taratura da 25 a 250 bar (C)
Pressione di taratura da 7 a 70 bar (CM)

13 Taratura del limitatore di coppia (in decine di bar)

da 18 a 180 bar
(deve essere compresa dal 30 all'80% del massimo valore tarato sul compensatore)

14 Serie

30 - C/CV
13 - CT
14 - CVT

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Released 8-1-90

VICKERS
A TRINOVA Company

Vickers Incorporated
5445 Corporate Drive
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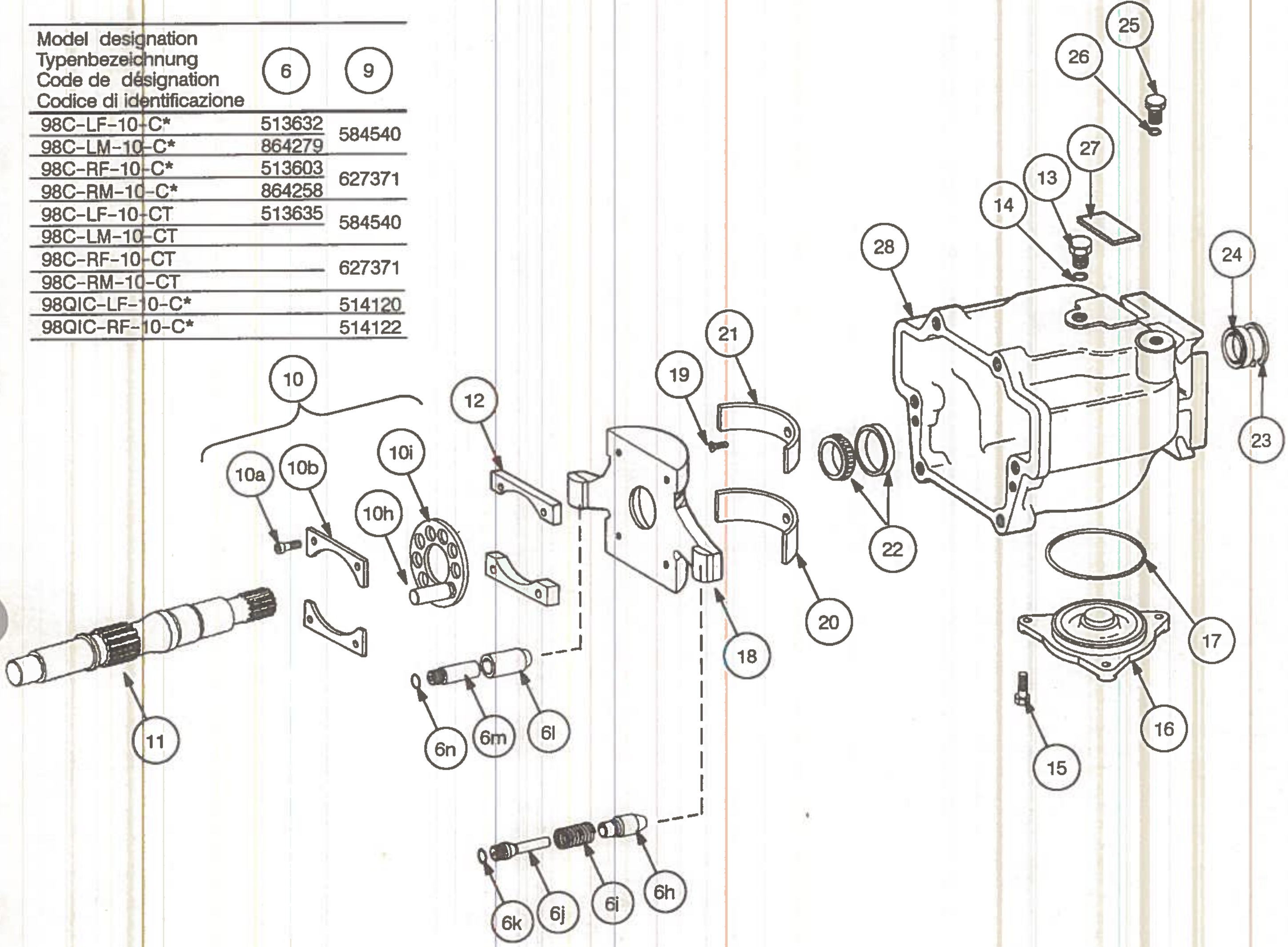
Troy, Michigan 48007-0302
U.S.A.

The right to modifications for technical improvements is reserved.

Printed in U.S.A.

Model designation Typenbezeichnung Code de désignation Codice di identificazione	②	②f	②m	②q	②r	Pressure range Druckbereich Plage de tarage Pressione di taratura
98C-**-10-C	02-125160	857681	-------	627391	154128	70-250 Bar
98C-**-10-CM	02-125162	857675	-------	627391	154128	35-140 Bar
98C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	⑥	⑨
98C-LF-10-C*	513632	584540
98C-LM-10-C*	864279	
98C-RF-10-C*	513603	627371
98C-RM-10-C*	864258	
98C-LF-10-CT	513635	584540
98C-LM-10-CT		
98C-RF-10-CT		627371
98C-RM-10-CT		
98QIC-LF-10-C*		514120
98QIC-RF-10-C*		514122



NOTE

Use shims (item 8) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 8 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

REMARQUE

Monter les cales d'épaisseur (rep. 8) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

NOTA

Usare spessori (particolare 8) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

NOTE

Right hand rotation shown. For left hand rotation install control rod (6m) & control piston (6l) in valve block port #2 & bias rod (6j), bias piston (6h), & spring (6i) in valve block port #1.

HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (6m) & Steuerkolben (6l) in Ventilblock Anschluß #2 und Haltestange (6j), Haltekolben (6h) & (6i) in Ventilblock Anschluß #1 motieren.

REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (6m) et le piston (6l) de commande dans l'orifice n° 2, et d'autre part la tige (6j) et le piston (6h) de maintien ainsi que le ressort (6i) dans l'orifice n° 1.

NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (6m) e il pistone di controllo (6l) nell'attacco del blocco valvola n.2; l'asta di reazione (6j), il pistone di reazione (6h) e la molla (6i) nell'attacco del blocco valvola n.1.

tem Pos. Rep. Pos.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
	473763 (4)		Screw	Schraube	Vis	Vite
2	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
2a	855564 (2)		Nut	Mutter	Ecrou	Dado
2b	857677		Plug	Stopfen	Bouchon	Tappo
2c	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
2d	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
2e	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
2f	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
2g	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
2h	857676	◇	Plug	Stopfen	Bouchon	Tappo
2i	154130	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
2j	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
2k	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
2l	857679	◇	Pin	Stift	Goupille de positionnement	Spina
2m	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
2n	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
2o	181728	◇	Plug	Stopfen	Bouchon	Tappo
2p	154128	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
2q	See table		Plug	Stopfen	Bouchon	Tappo
2r	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
2s	857672		Pressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
2t	857673	◇	Load sense spool	"Load sensing"-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
2u	177969 (3)		O-ring	O-Ring	Joint torique	O-Ring
2v	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
3	514574		Screw	Schraube	Vis	Vite
4	514573 (4)		Screw	Schraube	Vis	Vite
5	690406		Screw	Schraube	Vis	Vite
6	See table	*	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
6a	689461 (2)		Plug	Stopfen	Bouchon	Tappo
6b	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
6c	402643		Seat	Sitz	Siège	Sede
6d	402644		Poppet	Kegel	Clapet	Otturatore
6e	584455		Spring	Feder	Ressort	Molla
6f	248935		Pin	Stift	Goupille de positionnement	Spina
6g	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
6h	526669	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
6i	526666	▦	Spring	Feder	Ressort	Molla
6j	513600	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
6k	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
6l	526627	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
6m	526628	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
6n	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
6o	413603	■	Bearing	Lager	Roulement	Cuscinetto
7	513631		Gasket	Dichtung	Joint	Guarnizione
8	941441	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
9	See table		Valve plate	Ventilppatte	Glace de distribution	Piastra di distribuzione
10	877422	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
10a	473764 (4)	●	Screw	Schraube	Vis	Vite
10b	513626 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
10c	102038	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
10d	584547	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10e	627192	●	Spring	Feder	Ressort	Molla
10f	584546	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10g	680627	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
10h	926246	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
10i	584539	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
11	527167		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	513627		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	864453		Shaft (type 3)	Welle (Typ 3)	Arbre (type 3)	Albero (tipo 3)
	864454		Shaft (type 13)	Welle (Typ 13)	Arbre (type 13)	Albero (tipo 13)
11a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
12	513625 (2)		Spacer	Distanzstück	Entretoise	Distanziale
13	513602		Plug	Stopfen	Bouchon	Tappo
14	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
15	470793 (3)		Screw	Schraube	Vis	Vite
16	513347		Cover	Deckel	Couvercle	Coperchio
17	355659	▲	O-ring	O-Ring	Joint torique	O-Ring
18	513629		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
19	690339 (2)	■	Screw	Schraube	Vis	Vite
20	513911	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
21	513912	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
22	388154	■	Bearing	Lager	Roulement	Cuscinetto
23	126911		Retaining ring	Sprengring	Circlips	Anello di arresto
24	589332		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
25	181792		Plug	Stopfen	Bouchon	Tappo
26	396100	▲	O-ring	O-Ring	Joint torique	O-Ring
27	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
28	513645	*	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizione)
	864341	*	Housing (double seal)	Gehäuse (Doppeldichtung)	Carter (joint double)	Corpo (con doppia guarnizione)

✱ Not available for sale

▲ Available in single shaft seal kit 02-102263
Equivalent double shaft seal kit 02-102264

● Available in rotating group kit 877422

■ Available in bearing kit 877425

◇ Omit on C control S/A

▦ See assembly instructions

⊞ See assembly note

✱ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102263
Erhältlich als Doppelwellen Dichtungssatz 02-102264

● Erhältlich als Rotationsbaugruppe 877422.

■ Erhältlich als Lagersatz 877425

◇ Erhältlich bei Reglertyp C

▦ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

✱ Non disponible séparément.

▲ Compris dans la pochette 02-102263 (joint d ' arbre simple)
Pochette équivalente 02-102264 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877422.

■ Compris dans le kit de roulement 877425.

◇ Omis sur le sous-ensemble de commande C.

▦ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

✱ Non in vendita singolarmente

▲ Disponibile nella serie a singola guarnizione d ' albero 02-102263
Equivalente alla serie a doppia guarnizione 02-102264

● Disponibile nel kit per il gruppo rotante 877422

■ Disponibile nel kit dei cuscinetto 877425

◇ Omettere sul controllo C S/A

▦ Vedere istruzioni per il montaggio

⊞ Vedere nota per il montaggio

Item Pos. Rep. Pos.	Torque values Anziehmomente Couples de serrage Coppia di serraggio
1	31-37 Nm. (23-28 lb.ft.)
2a	8-10 Nm. (6-7.3 lb.ft.
2b	97-106 Nm. (71-78 lb.ft.)
2h	75-83 Nm. (55-60 lb.ft.)
2o	29-32 Nm. (21-24 lb.ft.)
2q	29-32 Nm. (21-24 lb.ft.)
3	83-102 Nm. (61-75 lb.ft.)
4	83-102 Nm. (61-75 lb.ft.)
5	83-102 Nm. (61-75 lb.ft.)
6a	12.7-13Nm. (8.9-9.5 lb.ft.)
6j	75-83 Nm. (55-60 lb.ft.)
6m	75-83 Nm. (55-60 lb.ft.)
10a	31-37 Nm. (23-27 lb.ft.)
13	97-106 Nm. (71-78 lb.ft.)
15	7-9 Nm. (5-6.6 lb.ft.)
19	3.6-4.4 Nm. (2.3-3 lb.ft.)
25	75-83 Nm. (55-60 lb.ft.)

All repairs must be made in clean conditions and by clean practices compatible with subsequent efficient operations of the unit in systems having filtration to 25µm or finer.

Bei Inbetriebnahme und Betrieb dieser Präzisionsgeräte ist die Filterung der Druckflüssigkeit - auf 25 µm oder feiner - Voraussetzung für optimale Wirtschaftlichkeit und Lebensdauer.

Toutes les réparations doivent être faites dans des conditions saines et par des moyens propres compatibles avec le fonctionnement correct de l'appareil dans un circuit filtré à 25 microns ou mieux.

Le riparazioni devono essere effettuate in ambiente pulito e in ogni caso in condizioni tali da consentirne un regolare funzionamento in sistemi idraulici con grado di filtrazione di 25 o più fine.

6 Configuration

Blank - Non thru drive
A - SAE "A" pad thru drive
B - SAE "B" pad thru drive
C - SAE "C" pad thru drive

8 Shaft

1 - SAE C Straight keyed
2 - SAE C Splined
3 - SAE CC Splined
13 - SAE CC Straight keyed

6 Bauart

Leer - Ohne durchg. Welle
A - SAE "A" Befestigung für durchg. Welle
B - SAE "B" Befestigung für durchg. Welle
C - SAE "C" Befestigung für durchg. Welle

8 Welle

1 - SAE "C" zylind. mit Paßfeder
2 - SAE "C" verzahnte Welle
3 - SAE "CC" verzahnte Welle
13 - SAE "CC" zylind. mit Paßfeder

6 Exécution

Omis - sans entraînement traversant
A - entraînement traversant avec plan de pose SAE A
B - entraînement traversant avec plan de pose SAE B
C - entraînement traversant avec plan de pose SAE C

8 Bout d'arbre

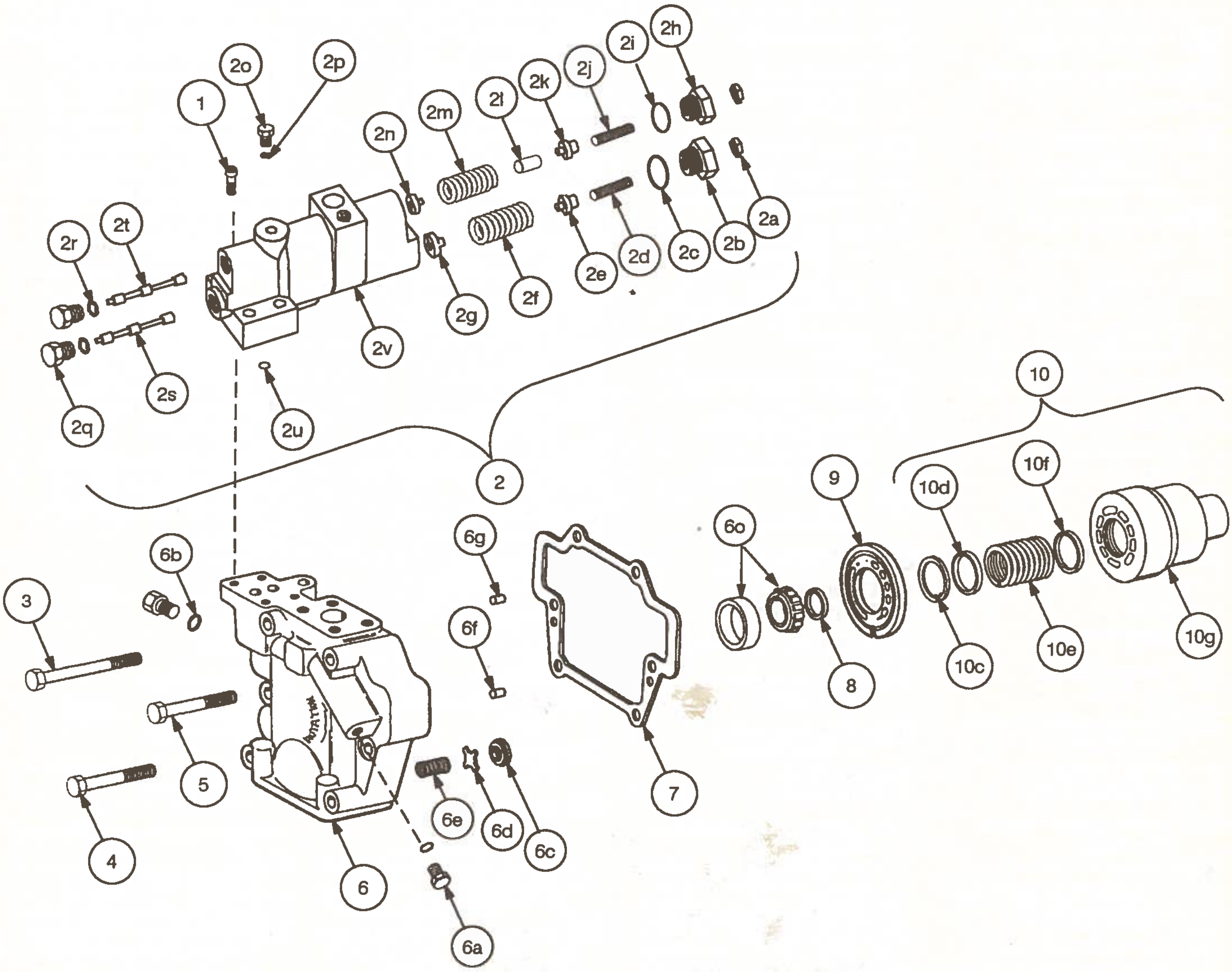
1 - cylindrique claveté SAE C
2 - cannelé SAE C
3 - cannelé SAE CC
13 - cylindrique claveté SAE CC

6 Configurazione

Vuoto - Albero non passante
A - Albero passante con flangia SAE "A"
B - Albero passante con flangia SAE "B"
C - Albero passante con flangia SAE "C"

8 Albero

1 - Cilindrico con chiavetta SAE "C"
2 - Scanalato SAE "C"
3 - Scanalato SAE "CC"
13 - Cilindrico con chiavetta SAE "CC"



11 Control Options

C - Pressure Compensator STD.
CM - Pressure Compensator
CV** - Pressure Compensator-with load sensing
CT**** - Pressure Compensator with torque limiter
CVT**** - Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C - Druckregler (Standard)
CM - Druckregler
CV** - Druckregler mit Load sensing
CT**** - Druckregler mit Drehmomentbegrenzer
CVT**** - Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C - compensateur de pression standard
CM - compensateur de pression
CV** - compensateur de pression "load-sensing"
CT**** - compensateur de pression avec limiteur de couple
CVT**** - compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C - Compensatore di pressione standard
CM - Compensatore di pressione
CV** - Compensatore di pressione con rilevatore di carico
CT**** - Compensatore di pressione con limitatore di coppia
CVT**** - compensatore di pressione con limitatore di coppia e rilevatore di carico

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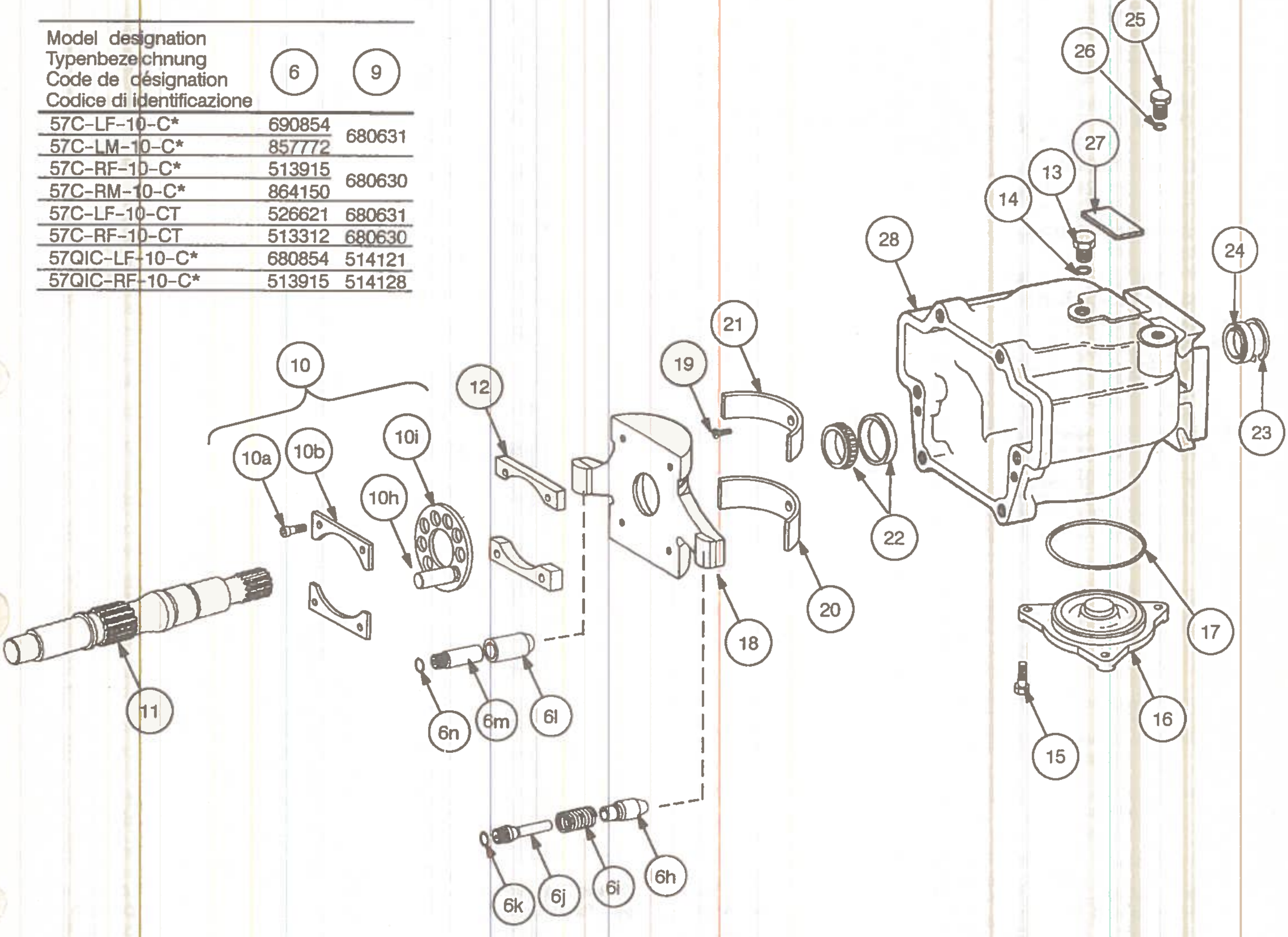
Spare parts information
Ersatzteilinformation
Fiche de pièces détachées
Bollettino parti di ricambio

VICKERS

Model designation Typenbezeichnung Code de désignation Codice di identificazione	②	②f	②m	②q	②r	Pressure range Druckbereich Plage de tarage Pressione di taratura
57C-**-10-C	02-125160	857681	-------	627391	154128	70-250 Bar
57C-**-10-CM	02-125162	857675	-------	627391	154128	35-140 Bar
57C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	⑥	⑨
57C-LF-10-C*	690854	680631
57C-LM-10-C*	857772	
57C-RF-10-C*	513915	680630
57C-RM-10-C*	864150	
57C-LF-10-CT	526621	680631
57C-RF-10-CT	513312	680630
57QIC-LF-10-C*	680854	514121
57QIC-RF-10-C*	513915	514128



⊞ NOTE

Use shims (item 8) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

⊞ HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 8 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

⊞ REMARQUE

Monter les cales d'épaisseur (rep. 8) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

⊞ NOTA

Usare spessori (particolare 8) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

⊞ NOTE

Right hand rotation shown. For left hand rotation install control rod (6m) & control piston (6l) in valve block port #2 & bias rod (6j), bias piston (6h), & spring (6i) in valve block port #1.

⊞ HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (6m) & Steuerkolben (6l) in Ventilblock Anschluß #2 und Haltestange (6j), Haltekolben (6h) & (6i) in Ventilblock Anschluß #1 motieren.

⊞ REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (6m) et le piston (6l) de commande dans l'orifice n° 2, et d'autre part la tige (6j) et le piston (6h) de maintien ainsi que le ressort (6i) dans l'orifice n° 1.

⊞ NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (6m) e il pistone di controllo (6l) nell'attacco del blocco valvola n.2; l'asta di reazione (6j), il pistone di reazione (6h) e la molla (6i) nell'attacco del blocco valvola n.1.

Item Pos. Rep. Pos.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
1	473763 (4)		Screw	Schraube	Vis	Vite
2	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
2a	855564 (2)		Nut	Mutter	Ecrou	Dado
2b	857677		Plug	Stopfen	Bouchon	Tappo
2c	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
2d	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
2e	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
2f	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
2g	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
2h	857676	◇	Plug	Stopfen	Bouchon	Tappo
2i	154130	▲◇	O-ring	O-Ring	Joint torique	O-Ring
2j	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
2k	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
2l	857679	◇	Pin	Stift	Goupille de positionnement	Spina
2m	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
2n	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
2o	181728	◇	Plug	Stopfen	Bouchon	Tappo
2p	154128	▲◇	O-ring	O-Ring	Joint torique	O-Ring
2q	See table		Plug	Stopfen	Bouchon	Tappo
2r	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
2s	857672		Pressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
2t	857673	◇	Load sense spool	"Load sensing"-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
2u	177969 (3)	▲	O-ring	O-Ring	Joint torique	O-Ring
2v	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
3	474753		Screw	Schraube	Vis	Vite
4	470866 (4)		Screw	Schraube	Vis	Vite
5	470871		Screw	Schraube	Vis	Vite
6	See table	✻	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
6a	689461 (2)		Plug	Stopfen	Bouchon	Tappo
6b	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
6c	402643		Seat	Sitz	Siège	Sede
6d	402644		Poppet	Kegel	Clapet	Otturatore
6e	584455		Spring	Feder	Ressort	Molla
6f	248935		Pin	Stift	Goupille de positionnement	Spina
6g	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
6h	526668	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
6i	526665	▦	Spring	Feder	Ressort	Molla
6j	526685	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
6k	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
6l	690211	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
6m	690210	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
6n	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
6o	513436	■	Bearing	Lager	Roulement	Cuscinetto
7	513846		Gasket	Dichtung	Joint	Guarnizione
8	926258	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
9	See table		Valve plate	Ventilppatte	Glace de distribution	Piastra di distribuzione
10	877420	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
10a	473741 (4)	●	Screw	Schraube	Vis	Vite
10b	690218 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
10c	85560	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
10d	584524	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10e	627524	●	Spring	Feder	Ressort	Molla
10f	680624	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10g	680625	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
10h	926257	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
10i	584512	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
11	527166		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	864342		Shaft (type 1) Thru	Welle (Typ 1) durchgehend	Arbre (type 1) (traversant)	Albero (tipo 1 passante)
	513839		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	526684		Shaft (type 2) Thru	Welle (Typ 2) durchgehend	Arbre (type 2) (traversant)	Albero (tipo 2 passante)
	883083		Shaft (type N)	Welle (Typ N)	Arbre (N)	Albero (tipo N)
11a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
	472287		Key (type N)	Paßfeder (Typ N)	Clavette (type N)	Chiavetta (tipo N)
12	690801 (2)		Spacer	Distanzstück	Entretoise	Distanziale
13	513602		Plug	Stopfen	Bouchon	Tappo
14	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
15	470793 (3)		Screw	Schraube	Vis	Vite
16	526616		Cover	Deckel	Couvercle	Coperchio
17	576601	▲	O-ring	O-Ring	Joint torique	O-Ring
18	690832		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
19	690339	■	Screw	Schraube	Vis	Vite
20	513885	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
21	513886	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
22	513433	■	Bearing	Lager	Roulement	Cuscinetto
23	103824		Retaining ring	Sprengring	Circlips	Anello di arresto
24	513439		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
25	186580		Plug	Stopfen	Bouchon	Tappo
26	396098	▲	O-ring	O-Ring	Joint torique	O-Ring

Item Pos. Rep. Pos.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
27	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
28	526614	∗	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizione)
	864204	∗	Housing (double seal)	Gehäuse (Doppeldichtung)	Carter (joint double)	Corpo (con doppia guarnizione)
	883084	∗	Housing (metric single seal)	Gehäuse (Einzeldichtung metrisch)	Carter (joint métrique simple)	Corpo (con singola guarnizione metrica)
29	See table	∗	Valve block (SAE "A" pad)	Ventilblock (SAE "A")	Bloc de distribution (plan de pose SAE A)	Blocco distributore (interfaccia SAE "A")
30	526682		Coupling (SAE "A")	Kupplung (SAE "A")	Accouplement (SAE A)	Giunto (SAE "A")
	526694		Coupling (SAE "B")	Kupplung (SAE "B")	Accouplement (SAE B)	Giunto(SAE "B")
	526696		Coupling (SAE "C")	Kupplung (SAE "C")	Accouplement (SAE C)	Giunto (SAE "C")
31	See table	☐	Adapter (SAE "B"/"C" pad)	Adapter (SAE "B"/"C")	Adaptateur (plan de pose SAE B/C)	Giunto (interfaccia SAE "B"/"C")
32	576601		O-ring (SAE "A" pad)	O-Ring (SAE "A")	Joint torique (plan de pose SAE A)	O-ring (interfaccia SAE "A")
	401525	▲☐	O-ring (SAE "B" adapter)	O-Ring (SAE "B")	Joint torique (adaptateur SAE B)	O-ring (adattatore SAE "B")
	353264	☐	O-ring (SAE "C" adapter)	O-Ring (SAE "C")	Joint torique (adaptateur SAE C)	O-ring (adattatore SAE "C")
33	474758 (2)		Screw	Schraube	Vis	Vite
34	470866 (2)		Screw	Schraube	Vis	Vite
35	474756 (2)		Screw (SAE "A" pad)	Schraube (SAE "A")	Vis (plan de pose SAE A)	Vite (interfaccia SAE "A")
	473800 (2)	☐	Screw (SAE "B"/"C" adapter)	Schraube (SAE "B"/"C")	Vis (adaptateur SAE B/C)	Vite (adattatore SAE "B"/"C")

∗ Not available for sale

▲ Available in single shaft seal kit 02-102260
Equivalent double shaft seal kit 02-102244

● Available in rotating group kit 877420

■ Available in bearing kit 877423

☐ Available in adapter pad kit
876390 SAE B (inch)
876394 SAE B (metric)
876389 SAE C (inch)
876392 SAE C (metric)

◇ Omit on C control S/A

⠿ See assembly instructions

⊞ See assembly note

∗ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102260
Erhältlich als Doppelwellen Dichtungssatz 02-102244

● Erhältlich als Rotationsbau gruppe 877420.

■ Erhältlich als Lagersatz 877423

☐ Erhältlich als Adapter satz
876390 SAE B (Zoll)
876394 SAE B (metrisch)
876389 SAE C (Zoll)
876392 SAE C (metrisch)

◇ Erhältlich bei Reglertyp C

⠿ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

∗ Non disponible séparément.

▲ Compris dans la pochette 02-102260 (joint d ' arbre simple)
Pochette équivalente 02-102244 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877420.

■ Compris dans le kit de roulement 877423.

☐ Compris dans le kit de plan de pose:
876390 SAE B (pouces)
876394 SAE B (métrique)
876389 SAE C (pouces)
876392 SAE C (métrique)

◇ Omis sur le sous-ensemble de commande C.

⠿ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

∗ Non in vendita singolarmente

▲ Disponibile nella serie a singo guarnizione d ' albero 02-102260
Equivalente alla serie a doppi guarnizione 02-102244

● Disponibile nel kit per il gruppo rotante 877420

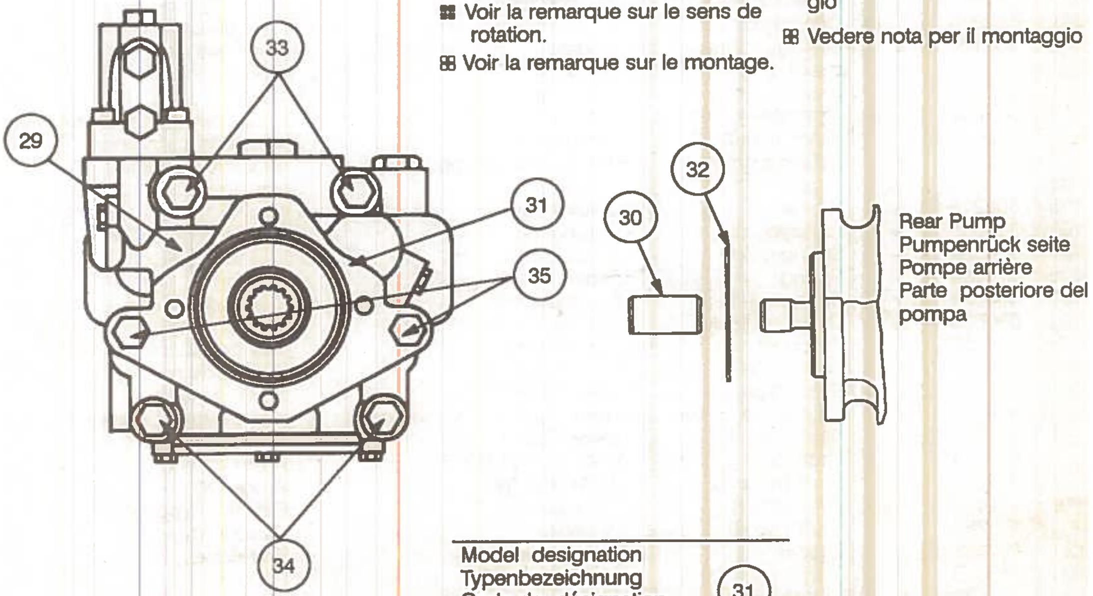
■ Disponibile nel kit del cusci netto 877423

☐ Disponibile nel kit di interfacc per l'adattatore
876390 SAE B (pollici)
876394 SAE B (metrico)
876389 SAE C (pollici)
876392 SAE C (metrico)

◇ Omettere sul controllo C S/A

⠿ Vedere istruzioni per il montag gio

⊞ Vedere nota per il montaggio



Model designation Typenbezeichnung Code de désignation Codice di identificazione	㉙
57*-LAF-10-C	526660
57*-LAM-10-C	864257
57*-RAF-10-C	526658
57*-RAM-10-C	864239
57*-LAF-10-CT	526662
57*-RAF-10-CT	526661

Model designation Typenbezeichnung Code de désignation Codice di identificazione	㉛
57*-*BF-10-C	526670
57*-*BM-10-C	876393
57C-*CF-10-C	692934
57C-*CM-10-C	876391

6 Configuration

Blank – Non thru drive
A – SAE "A" pad thru drive
B – SAE "B" pad thru drive
C – SAE "C" pad thru drive

6 Bauart

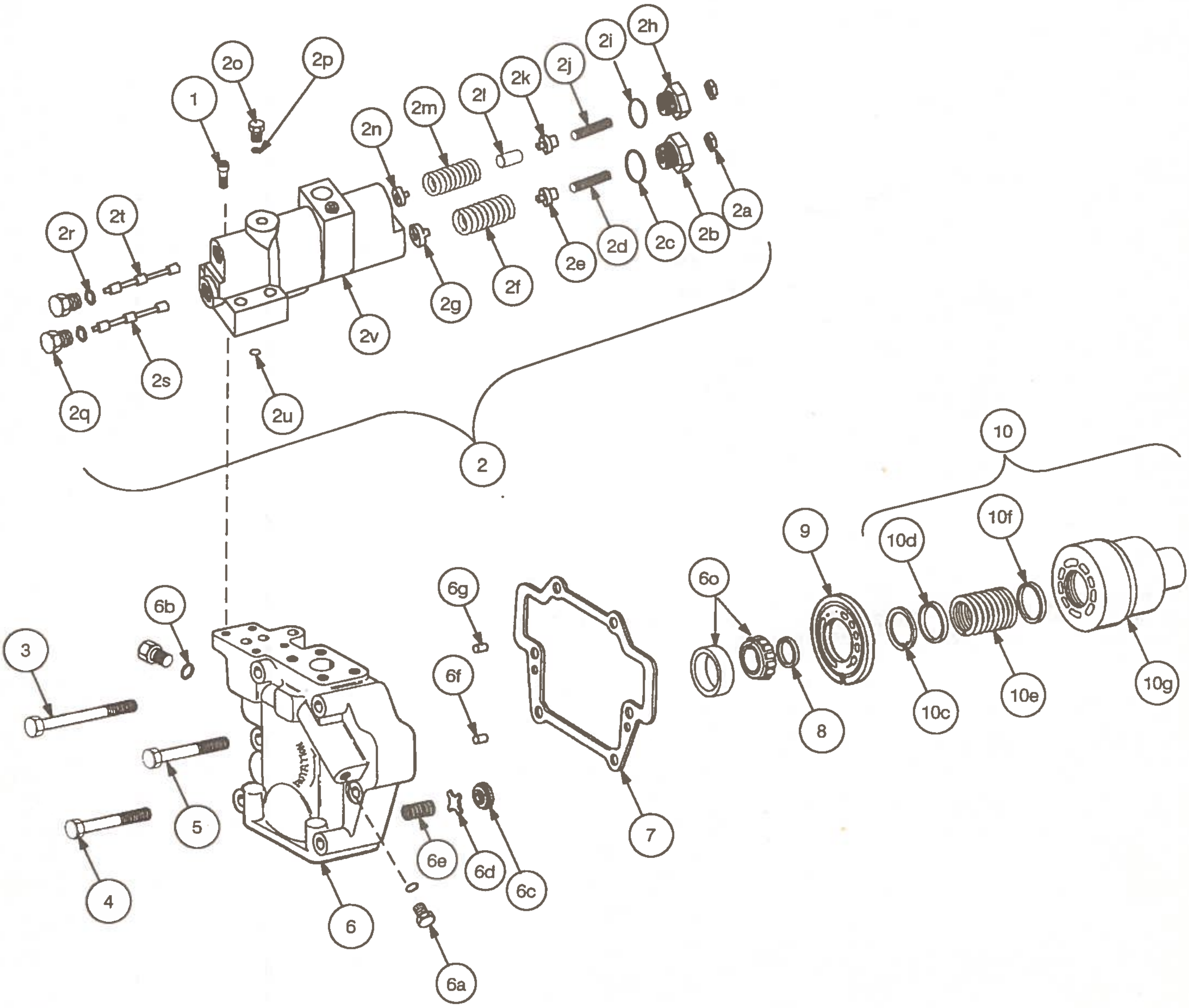
Leer – Ohne durchg. Welle
A – SAE "A" Befestigung für durchg. Welle
B – SAE "B" Befestigung für durchg. Welle
C – SAE "C" Befestigung für durchg. Welle

6 Exécution

Omis – sans entraînement traversant
A – entraînement traversant avec plan de pose SAE A
B – entraînement traversant avec plan de pose SAE B
C – entraînement traversant avec plan de pose SAE C

6 Configurazione

Vuoto – Albero non passante
A – Albero passante con flangia SAE "A"
B – Albero passante con flangia SAE "B"
C – Albero passante con flangia SAE "C"



11 Control Options

C – Pressure Compensator STD.
CM – Pressure Compensator
CV** – Pressure Compensator-with load sensing
CT**** – Pressure Compensator with torque limiter
CVT**** – Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C – Druckregler (Standard)
CM – Druckregler
CV** – Druckregler mit Load sensing
CT**** – Druckregler mit Drehmomentbegrenzer
CVT**** – Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C – compensateur de pression standard
CM – compensateur de pression
CV** – compensateur de pression "load-sensing"
CT**** – compensateur de pression avec limiteur de couple
CVT**** – compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C – Compensatore di pressione standard
CM – Compensatore di pressione
CV** – Compensatore di pressione con rilevatore di carico
CT**** – Compensatore di pressione con limitatore di coppia
CVT**** – compensatore di pressione con limitatore di coppia e rilevatore di carico

① 3

Spare parts information
Ersatzteilinformation
Fiche de pièces détachées
Bollettino parti di ricambio

VICKERS

Piston pump
Kolbenpumpe
Pompe à pistons
Pompa a pistoni

98

PVH 57 (QI) C–R A F–1–S–10–C 25 VT 18–14

PVH	57	(QI)	C	R	A	F	1	S	10	C	25	V	T	18	14
1	2	3	4	5	6	7	8	9	10	11	12	13		13	14

1 PVH Model Series

2 Variable Displacement

57- 57 cc/r

3 Quiet Version

Blank – Mobile version
QI – Quiet industrial

4 Mounting Flange

C – SAE "C" , 4 bolt
M – ISO-3019-2

5 Rotation
(Viewed from shaft end)

R – Clockwise rotation
L – Counterclockwise rotation

6 Configuration (see table)

7 Port Connections

F – SAE flange ports
M – Metric flange ports

8 Shaft

1 – SAE C Straight keyed
2 – SAE C Splined
N – ISO 3019-2 Straight keyed

9 Shaft Seal

S – Single
D – Double

10 Pump Design

11 Control Options
(see table)

12 Pressure Comp. Setting
(Tens of bar)

25 – 250 bar setting (C)
7 – 70 bar setting (CM)

13 Torque Limiter Setting
(Tens of bar)

18 – 180 bar
(Must be 30-80 % of Max. pressure compensator setting)

14 Control Design

30 – C/CV
13 – CT
14 – CVT

1 Baureihe PVH

2 Verstellbares Fördervolumen

57– 57 cm^3/u

3 Leise Ausführung

Leer – Mobil-Version
QI – Leise Industrie-Version

4 Bfestigungsflansch

C – SAE "C" , 4 Schrauben
M – ISO-3019-2

5 Drehrichtung
(Mit Blick auf Wellenende)

R – Rechtslauf
L – Linkslauf

6 Bauart (siehe tabelle)

7 Systemanschlüsse

F – SAE Flansche
M – Metrische Flansche

8 Welle

1 – SAE "C" zylind. mit Paßfeder
2 – SAE "C" verzahnte Welle
N – ISO 3019-2 zylind. mit Paßfeder

9 Wellendichtung

S – Einzeldichtung
D – Doppeldichtung

10 Seriennummer Pumpe

11 Reglervausführung
(siehe tabelle)

12 Reglereinstellung
(in 10 bar stufen)

25 – 250 bar (C)
7 – 70 bar (CM)

13 Einstellung Drehmomanbegrenzer
(in 10 bar Stufen)

18 – 180 bar
(Muß 30-80 % der max. Reglereinstellung betragen)

14 Seriennummer Regler

30 – C/CV
13 – CT
14 – CVT

1 Série PVH

2 Cylindrée variable

57 – 57 cm^3/tr

3 Version silencieuse

Omis – version mobile
QI – version industrielle silencieuse

4 Bride de montage

C – SAE C à 4 vis
M – ISO-3019-2

5 Sens de rotation
(vu du côté arbre)

R – horaire
L – anti-horaire

6 Exécution
(Voir le tableau)

7 Raccordement des orifices

F – bride SAE
M – bride métrique

8 Bout d'arbre

1 – cylindrique claveté SAE C
2 – cannelé SAE C
N – ISO 3019-2 cylindrique claveté

9 Joint d'arbre

S – Simple
D – Double

10 Numéro de dessin de pompe

11 Choix de commandes
(Voir le tableau)

12 Tarage du compensateur de pression
(en dizaines de bar)

25 – 250 bar (C)
7 – 70 bar (CM)

13 Réglage du limiteur de couple
(en dizaines de bar)

18 –180 bar
(Obligatoirement 30 à 80% du tarage maxi. de compensateur)

14 Numéro de dessin de la commande

30 – C/CV
13 – CT
14 – CVT

1 Modello serie PVH

2 Cilindrata variabile

57– 57 cc/r

3 Versione silenziosa

Vuoto – versione appl.mobile
QI – Versione silenziosa appl.industriali

4 Flangia di montaggio

C – 4 fori SAE "C"
M – ISO-3019-2

5 Rotazione
(vista dal lato albero)

R – Rotazione oraria
C – Rotazione antioraria

6 Configurazione
(vedi tabella)

7 Bocche di connessione

F – attacchi flangiati SAE
M – attacchi a flangia metriche

8 Albero

1 – Cilindrico con chiavetta SAE "C"
2 – Scanalato SAE "C"
N – ISO 3019-2 Cilindrico con chiavetta

9 Guarnizione albero

S – Singola
D – Doppia

10 Serie pompa

11 Opzioni sul controllo
(vedi tabella)

12 Taratura del compensatore di pressione
(in decine di bar)

Pressione di taratura da 25 a 250 bar (C)
Pressione di taratura da 7 a 70 bar (CM)

13 Taratura del limitatore di coppia (in decine di bar)

da 18 a 180 bar
(deve essere compresa dal 30 all'80% del massimo valore tarato sul compensatore)

14 Serie

30 – C/CV
13 – CT
14 – CVT

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MODEL CODE BREAKDOWN

M - PVB * - * S * - 21 - * - 10 - ***

MOBILE
APPLICATION

PUMP

VARIABLE
DISPLACEMENT

INLINE
PISTON
UNIT

FLOW RATING
@ 1800 RPM
10 - 10 USGPM
15 - 15 USGPM

ROTATION VIEWING
SHAFT END
R - CLOCKWISE
L - C'CLOCKWISE

SWASH PLATE MOVEMENT
S - SINGLE SIDE CENTER

SHAFT TYPE
G - SPLINED
(OMIT FOR
STANDARD)

PUMP
DESIGN
NUMBER

CONTROL TYPE
C - PRESSURE COMPENSATOR
(250 - 3000 P.S.I.)
CG - REMOTE COMPENSATOR
CR - DIFFERENTIAL CUTOFF COMPENSATOR
CV - LOAD SENSING COMPENSATOR

CONTROL DESIGN
C - 10
CG - 20
CR - 10
CV - 20

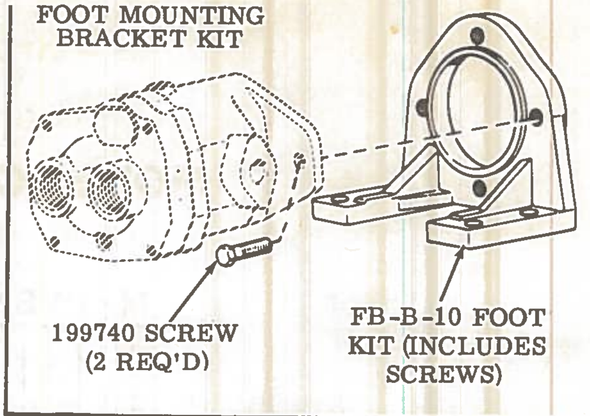
SPECIAL
FEATURE
NUMBER

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

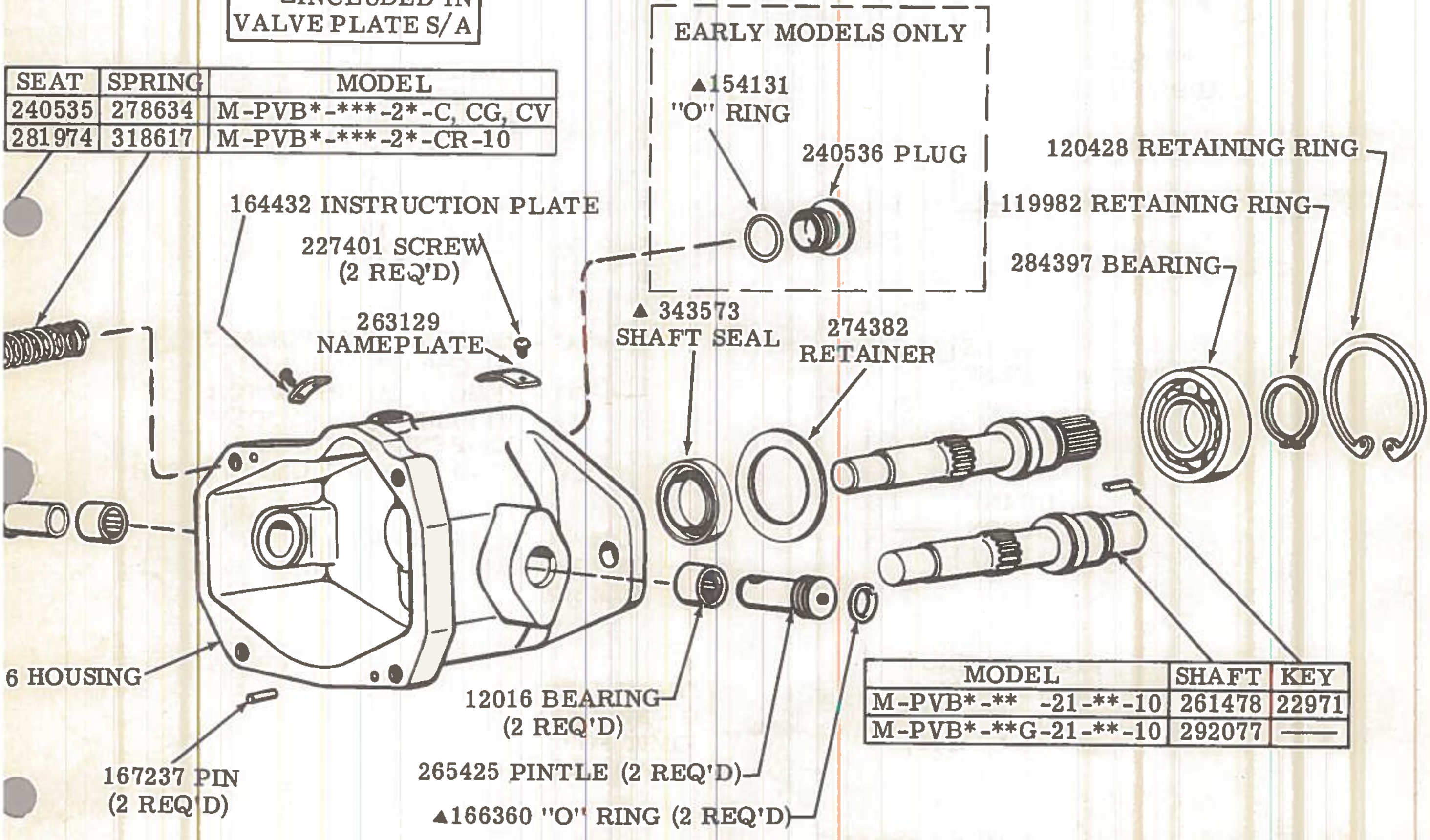
⊖CAUTION
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJ. PLUG.

□VALVE PLATE S/A INCLUDES 12016 BEARING	MODEL
938386	M-PVB10-R**-21-C(*)-*0
938385	M-PVB10-L**-21-C(*)-*0
938378	M-PVB15-R**-21-C(*)-*0
938377	M-PVB15-L**-21-C(*)-*0

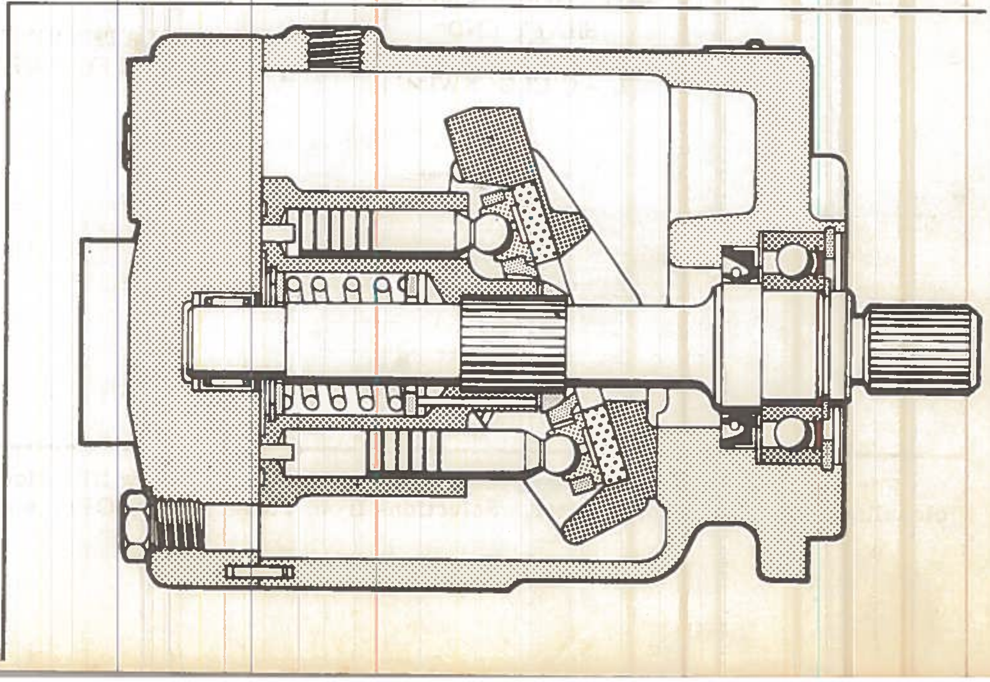


□INCLUDED IN VALVE PLATE S/A

SEAT	SPRING	MODEL
240535	278634	M-PVB*-***-2*-C, CG, CV
281974	318617	M-PVB*-***-2*-CR-10

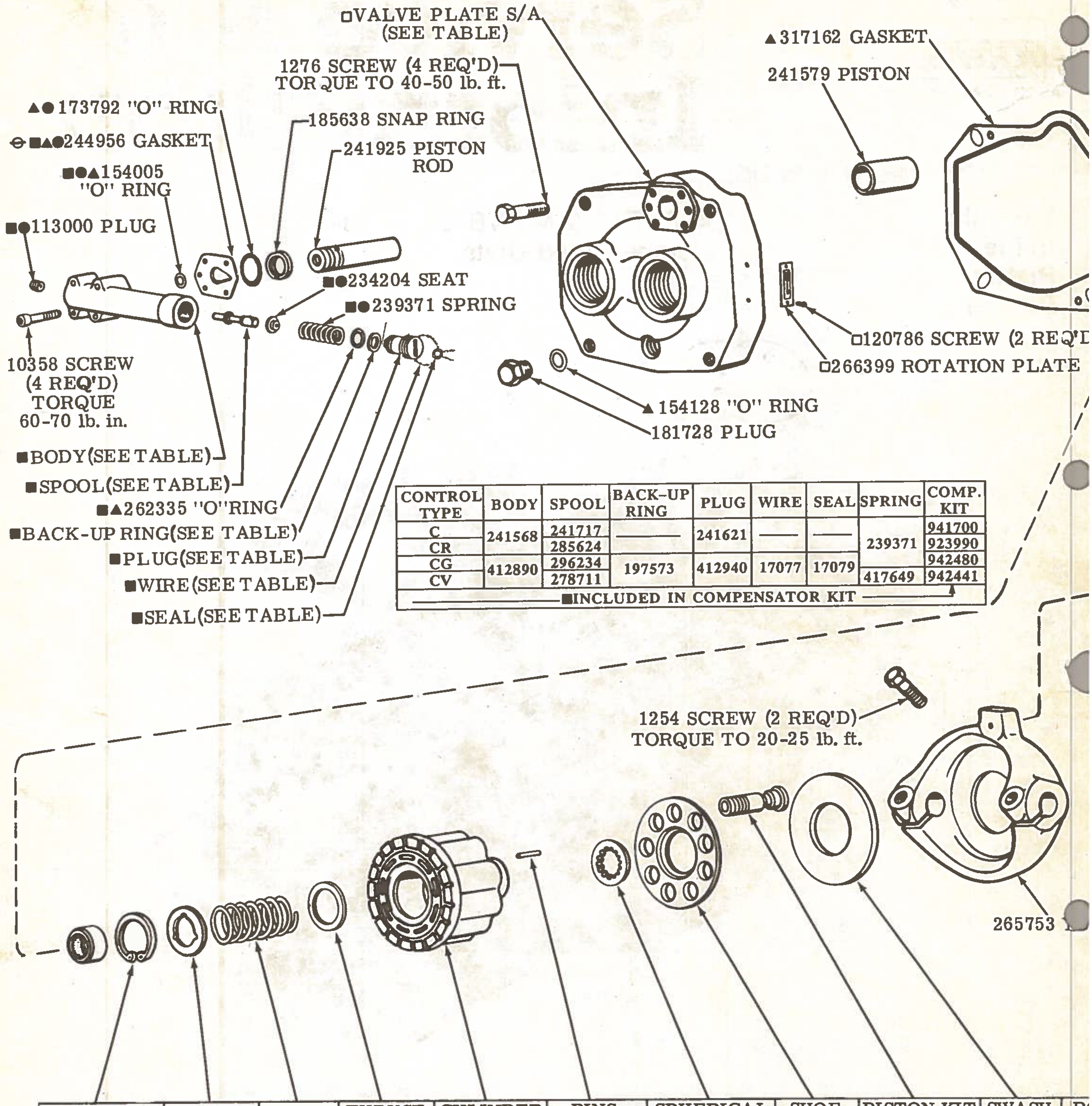


MODEL	SHAFT	KEY
M-PVB*-** -21-**-10	261478	22971
M-PVB*-**G-21-**-10	292077	——



▲INCLUDED IN SEAL KIT 919192

MODEL	
M-PVB10-***-21-**-*0	
M-PVB15-***-21-**-*0	



CONTROL TYPE	BODY	SPOOL	BACK-UP RING	PLUG	WIRE	SEAL	SPRING	COMP. KIT
C	241568	241717	———	241621	———	———	239371	941700
CR		285624						923990
CG	412890	296234	197573	412940	17077	17079		942480
CV		278711					417649	942441
■INCLUDED IN COMPENSATOR KIT								

RETAINING RING	LIFT LIMITER	SPRING	THRUST WASHER	CYLINDER BLOCK	PINS (3 REQ'D)	SPHERICAL WASHER	SHOE PLATE	PISTON KIT (9 PISTONS)	SWASH PLATE	R GR
THESE PARTS ARE SERVICED IN ROTATING GROUP KIT										
93509	245223	247294	241954	321703 260860	248811	423324	275961	942047 941887	239077	

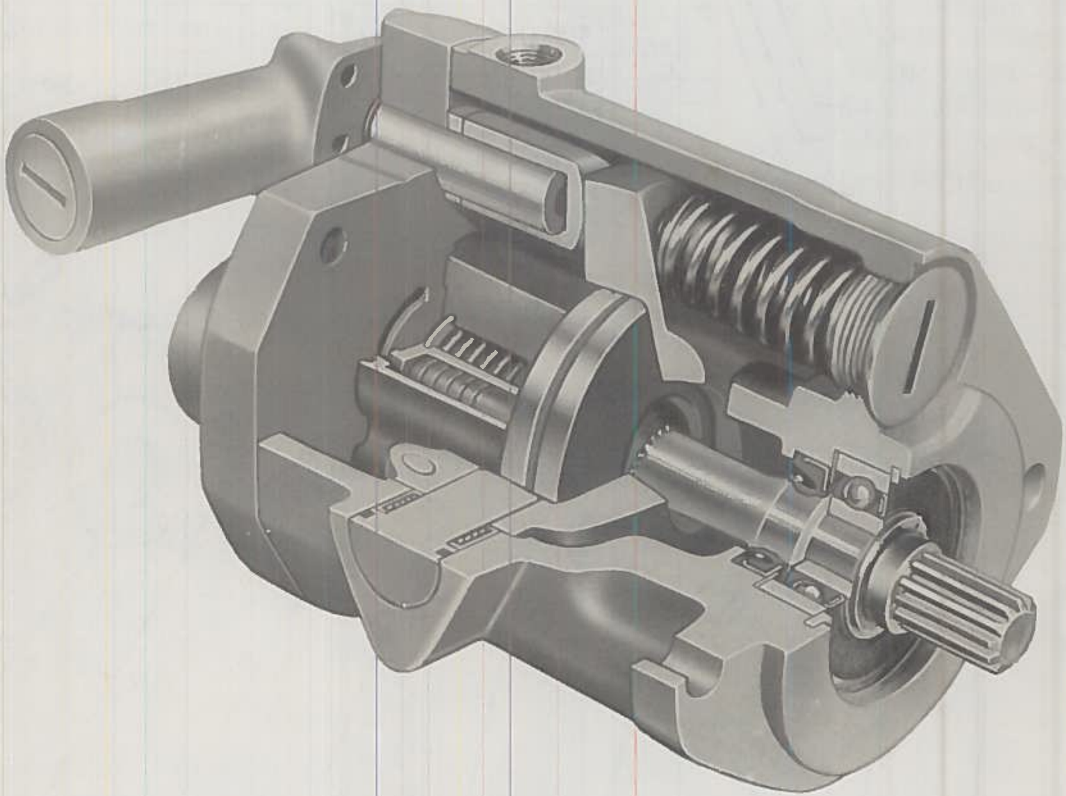
VICKERS®
A TRINOVA COMPANY

Service Parts Information

Variable
Inline
Piston
Pumps

M-PVB10 & M-PVB15 -21 Design Compensated Units

46



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Revised 12-1-87

M-2212-S

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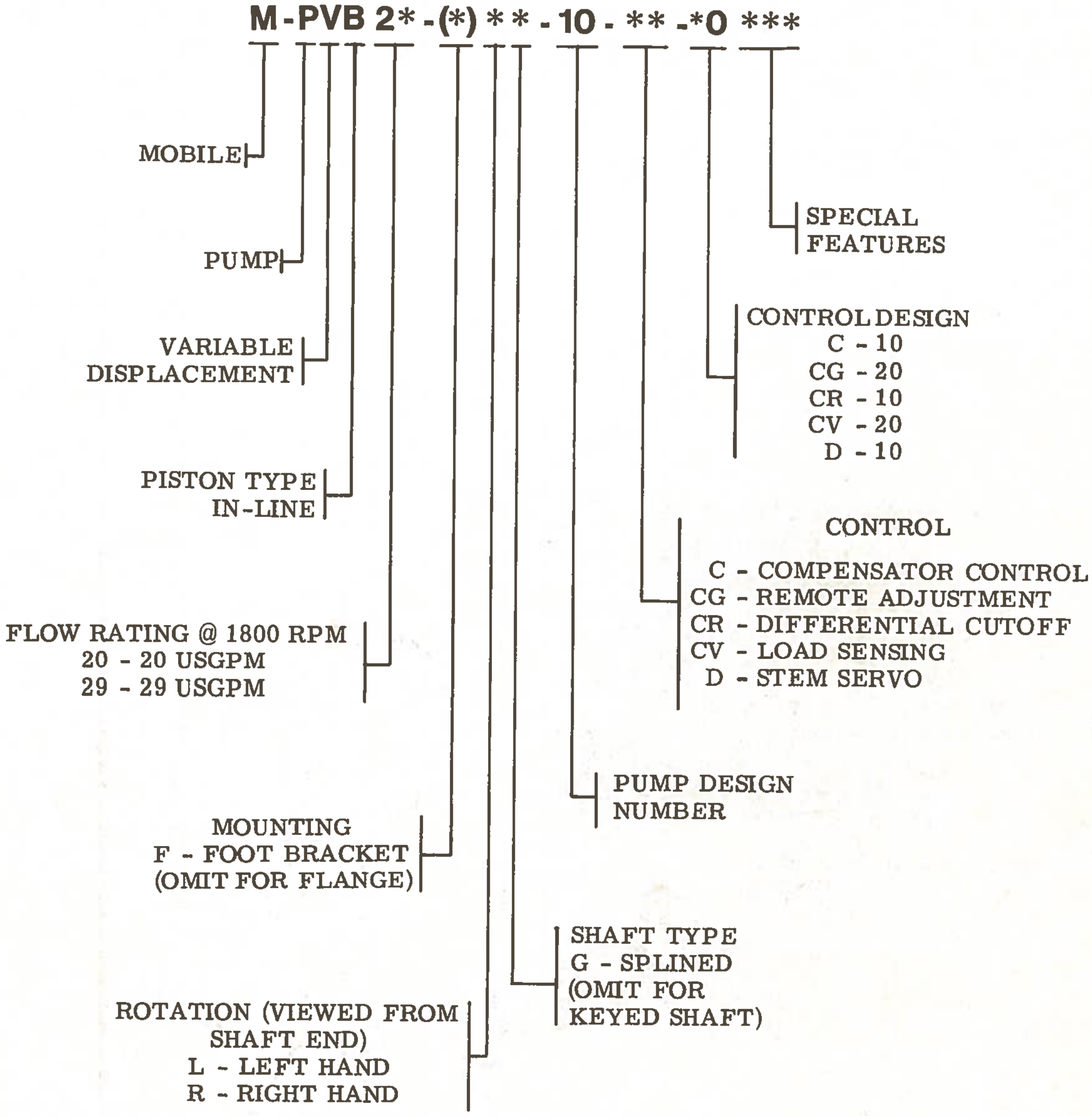
MODEL CODE BREAKDOWN



M-PVB 2*-(*) ** - 10 - ** -*0 ***

MOBILE

PUMP

VARIABLE
DISPLACEMENT

PISTON TYPE
IN-LINE

FLOW RATING @ 1800 RPM
20 - 20 USGPM
29 - 29 USGPM

MOUNTING
F - FOOT BRACKET
(OMIT FOR FLANGE)

ROTATION (VIEWED FROM
SHAFT END)
L - LEFT HAND
R - RIGHT HAND

SHAFT TYPE
G - SPLINED
(OMIT FOR
KEYED SHAFT)

PUMP DESIGN
NUMBER

CONTROL

C - COMPENSATOR CONTROL
CG - REMOTE ADJUSTMENT
CR - DIFFERENTIAL CUTOFF
CV - LOAD SENSING
D - STEM SERVO

CONTROL DESIGN
C - 10
CG - 20
CR - 10
CV - 20
D - 10

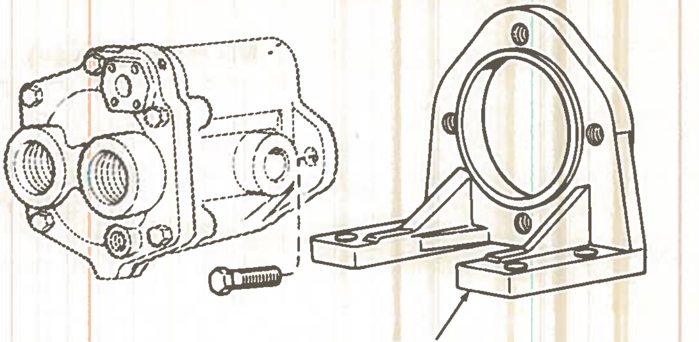
SPECIAL
FEATURES

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

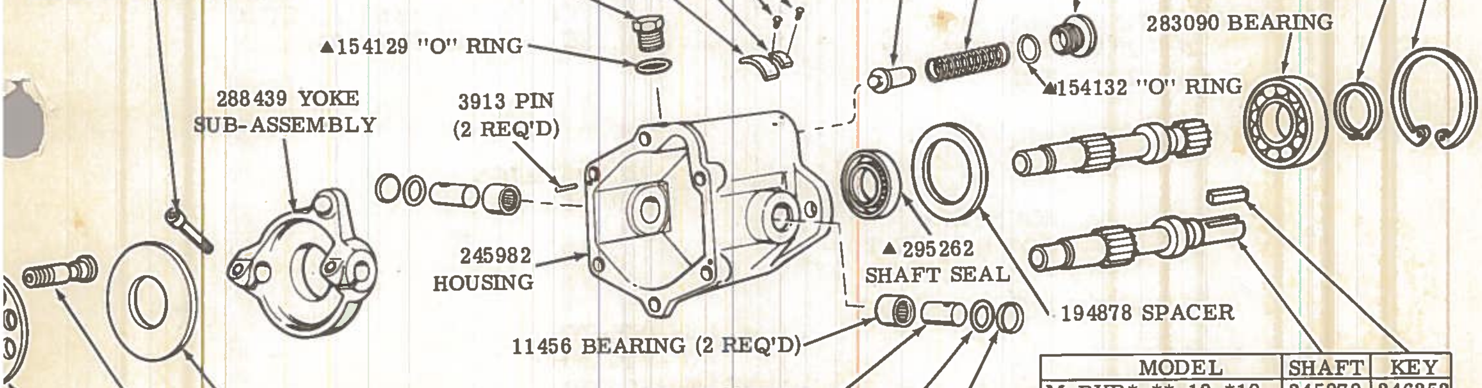
MAINTENANCE INFORMATION

FOOT MOUNTING BRACKET KIT



FB-C-10
(INCLUDES SCREWS)

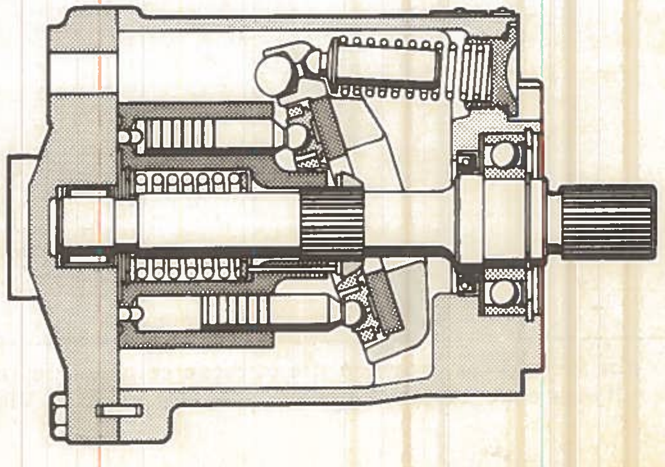
SEAT	SPRING	PLUG	MODEL
245975	436335	245973	M-PVB2*-***-11-C/CG-*0
306370	306434	306369	M-PVB2*-***-11-CR-10
245975	436335	245973	M-PVB2*-***-11-CV/D-*0



MODEL	SHAFT	KEY
M-PVB*-**-10-*10	245979	246353
M-PVB*-**G-10-*10	282880	——

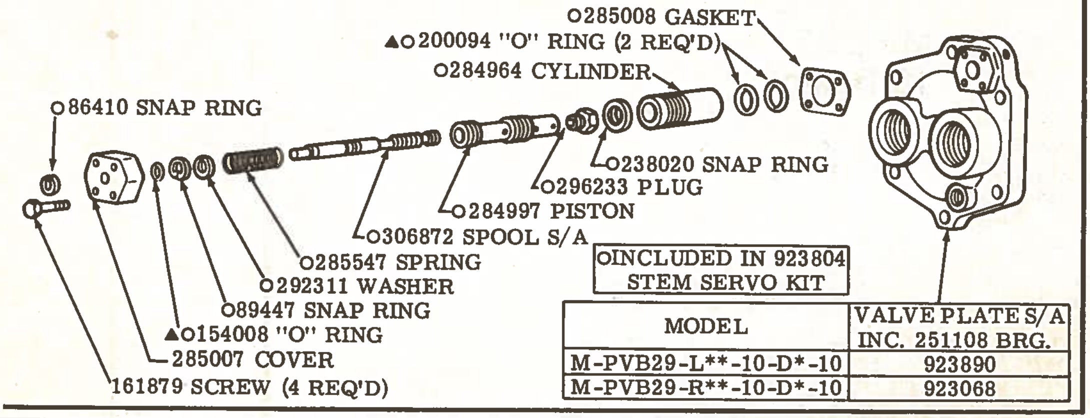
	SPHERICAL WASHER S/A	SHOE PLATE	PISTON KIT (9 PISTONS)	SWASH PLATE	ROTATING GROUP KIT
IN ROTATING GROUP KIT					
	938392	248609	941883 941888	239335	938280 938290

▲INCLUDED IN
923006 SEAL KIT



WARNING: USE THIS DRAWING FOR PARTS INFORMATION ONLY. SEE OVERHAUL MANU

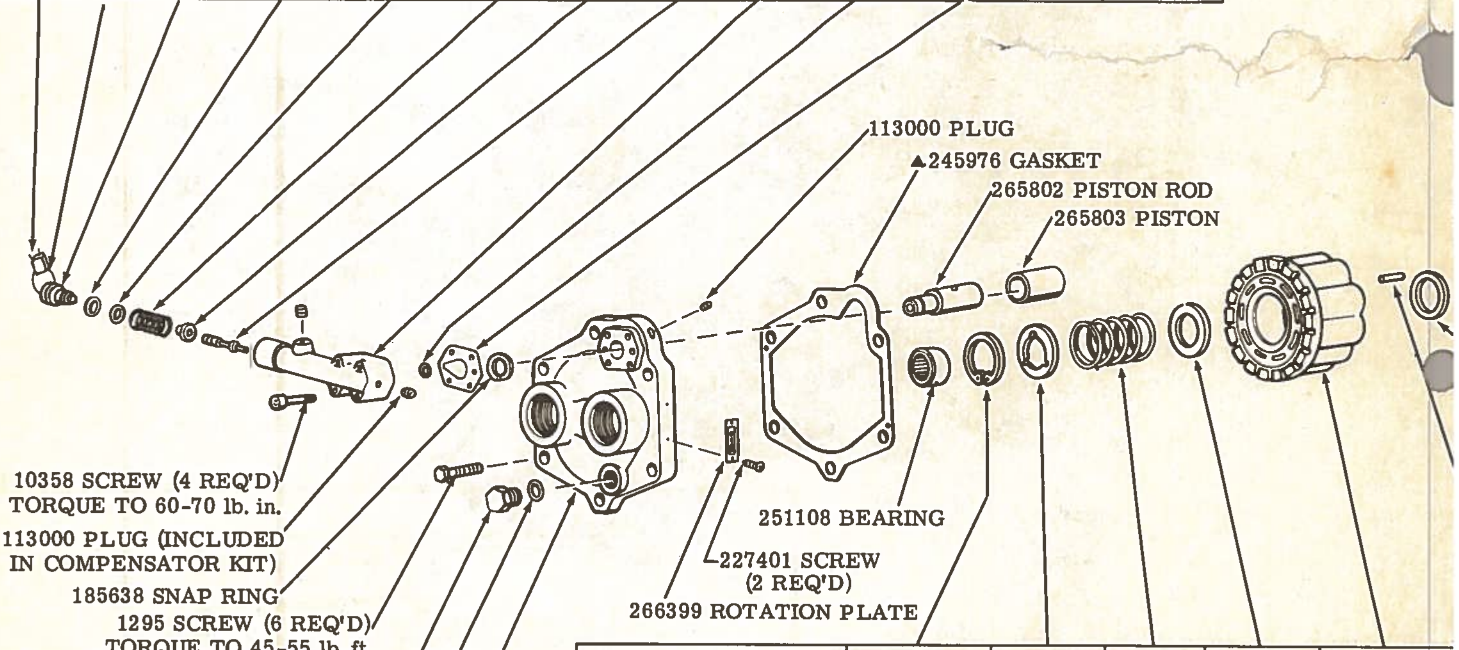
STEM SERVO CONTROL
M-PVB*-***-10/11-D*-10



○INCLUDED IN 923804
STEM SERVO KIT

MODEL	VALVE PLATE S/A INC. 251108 BRG.
M-PVB29-L**-10-D*-10	923890
M-PVB29-R**-10-D*-10	923068

INCLUDED IN COMPENSATOR SUBASSEMBLY KIT												
SEAL	SEAL WIRE	PLUG	BACK UP ▲RING	▲ "O"RING	SPRING	SEAT	SPOOL	BODY	▲ "O"RING	GASKET	COMP. KIT	CONTROL
——	——	241621	——	262335	239371	234204	241717	241568	154005	244956	941700	C
							285624				923990	CR
17079	17077	412940	197573				296234	412890			942480	CG
					417649		278711				942441	CV



MODEL	RETAINING RING	WASHER	SPRING	THRUST WASHER	CYLINDER BLOCK
	THESE PARTS				
M-PVB20-***-10-*-10	194025	244931	246386	238780	250688
M-PVB29-***-10-*-10			263582		259458

MODEL	VALVE PLATE S/A INC. 251108 BEARING
M-PVB20-R**-10-C-10	938400
M-PVB20-L**-10-C-10	938401
M-PVB29-R**-10-C-10	938404
M-PVB29-L**-10-C-10	938405

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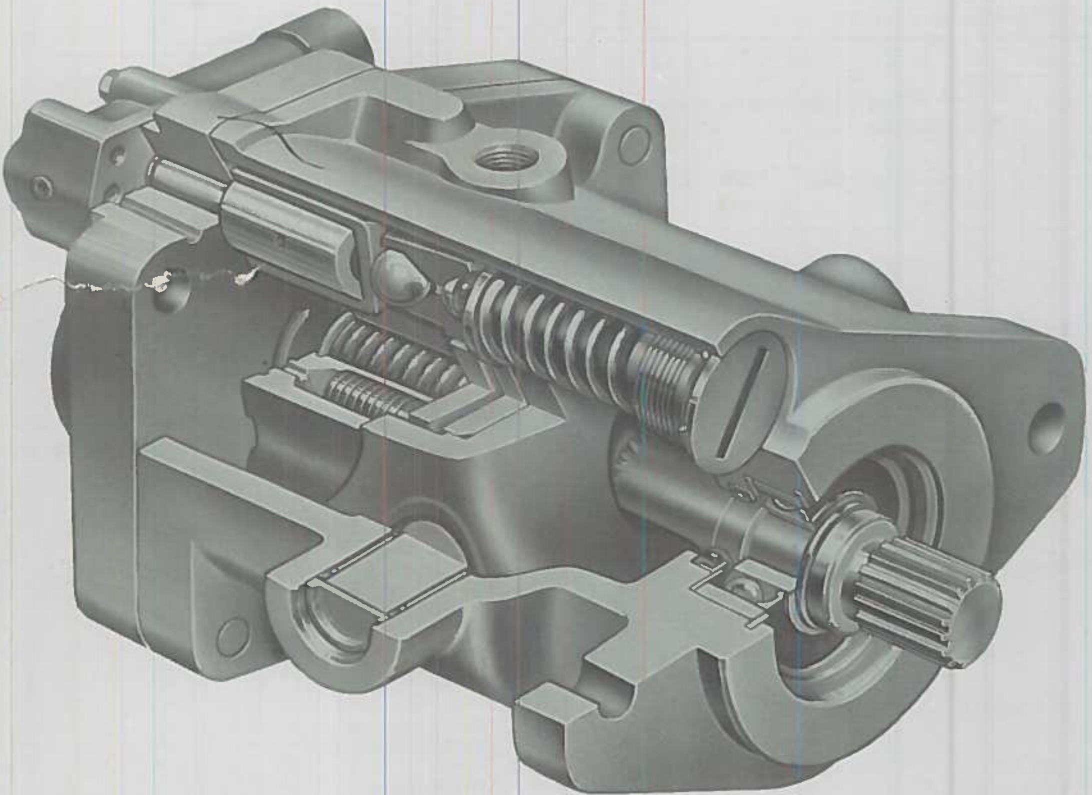
Service Parts Information

**Variable
Inline
Piston
Pumps**

M-PVB20
M-PVB29
10 Design

48



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Troy, Michigan 48084

Revised 12-1-87

M-2213-S

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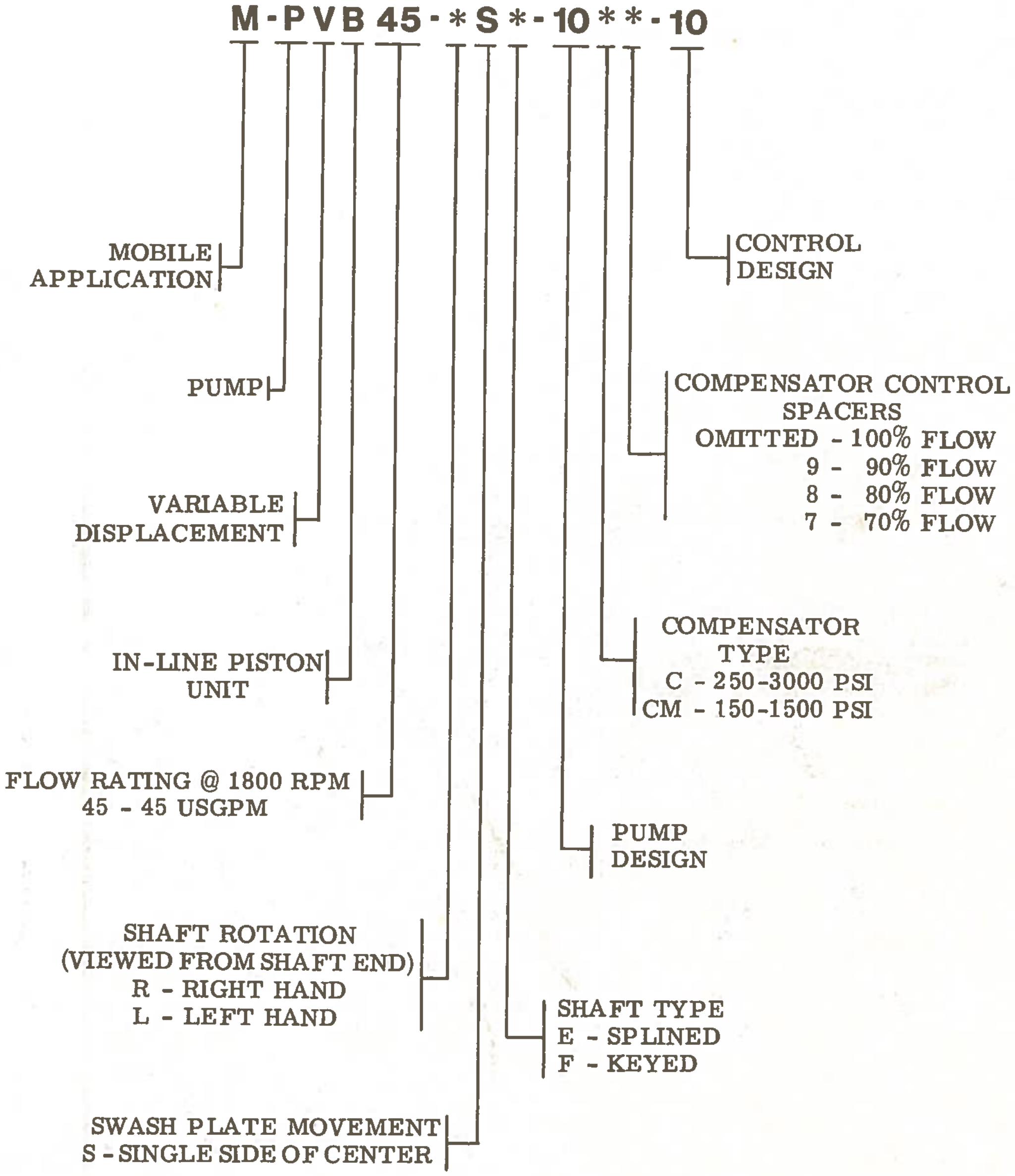
MODEL CODE BREAKDOWN



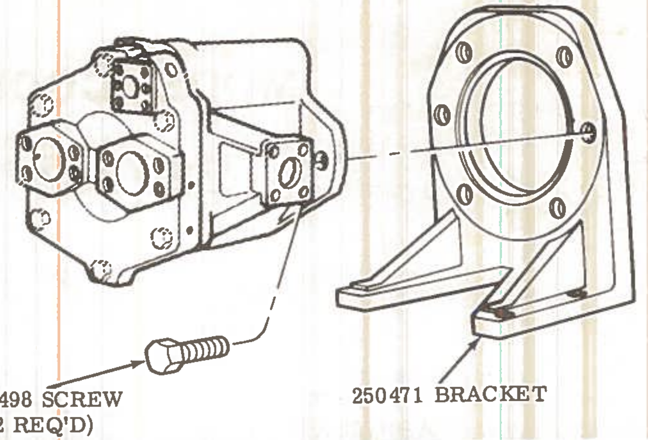
For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

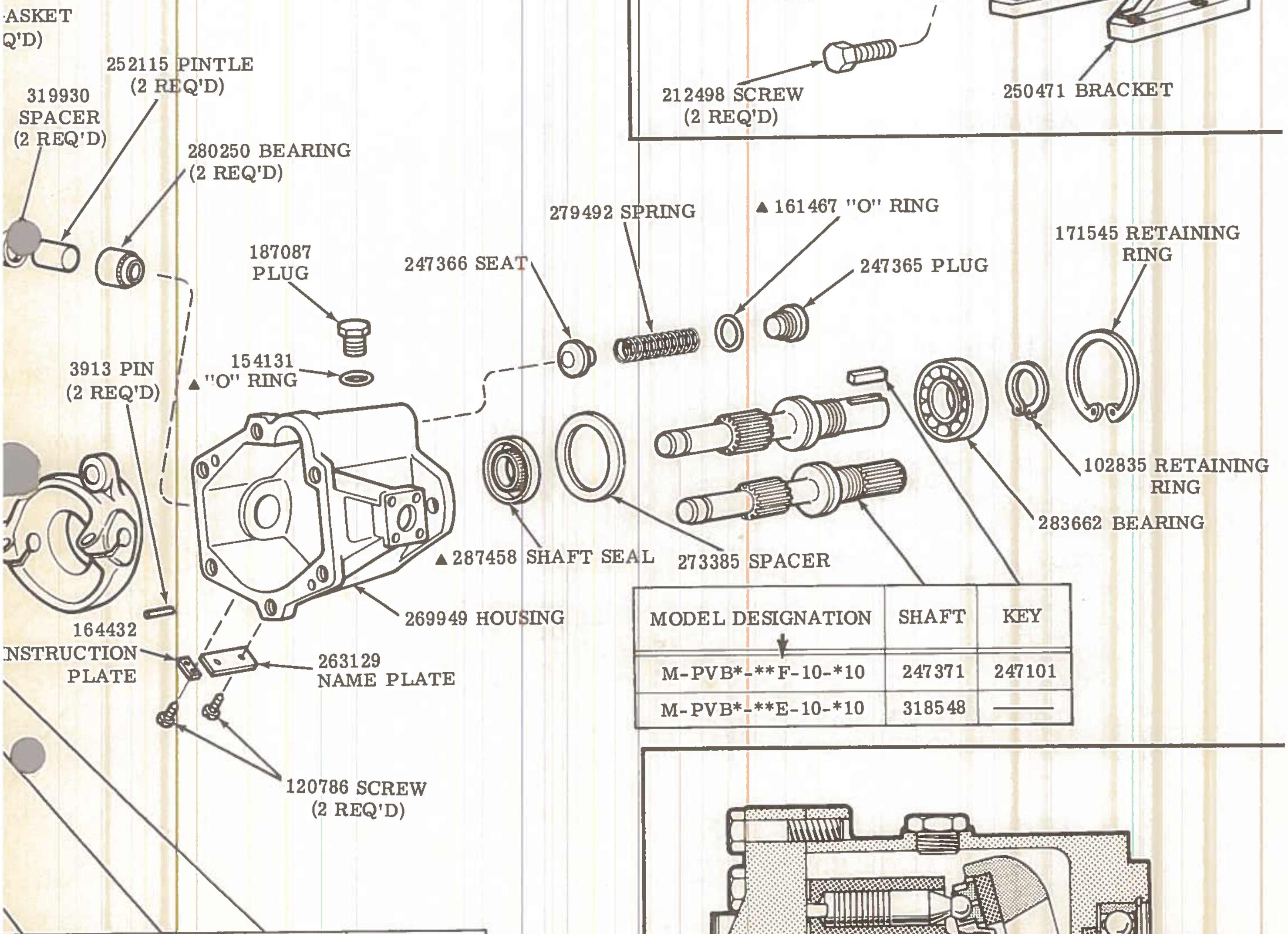
Litho in U.S.A.

●INCLUDED IN COMPENSATOR KIT

COMPENSATOR ●TYPE	SPRING	COMPENSATOR KIT
C	245087	941744
CM	285870	941745

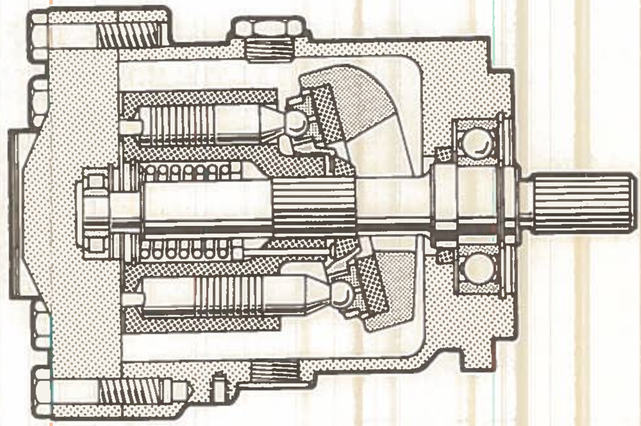
FOOT MOUNTING BRACKET



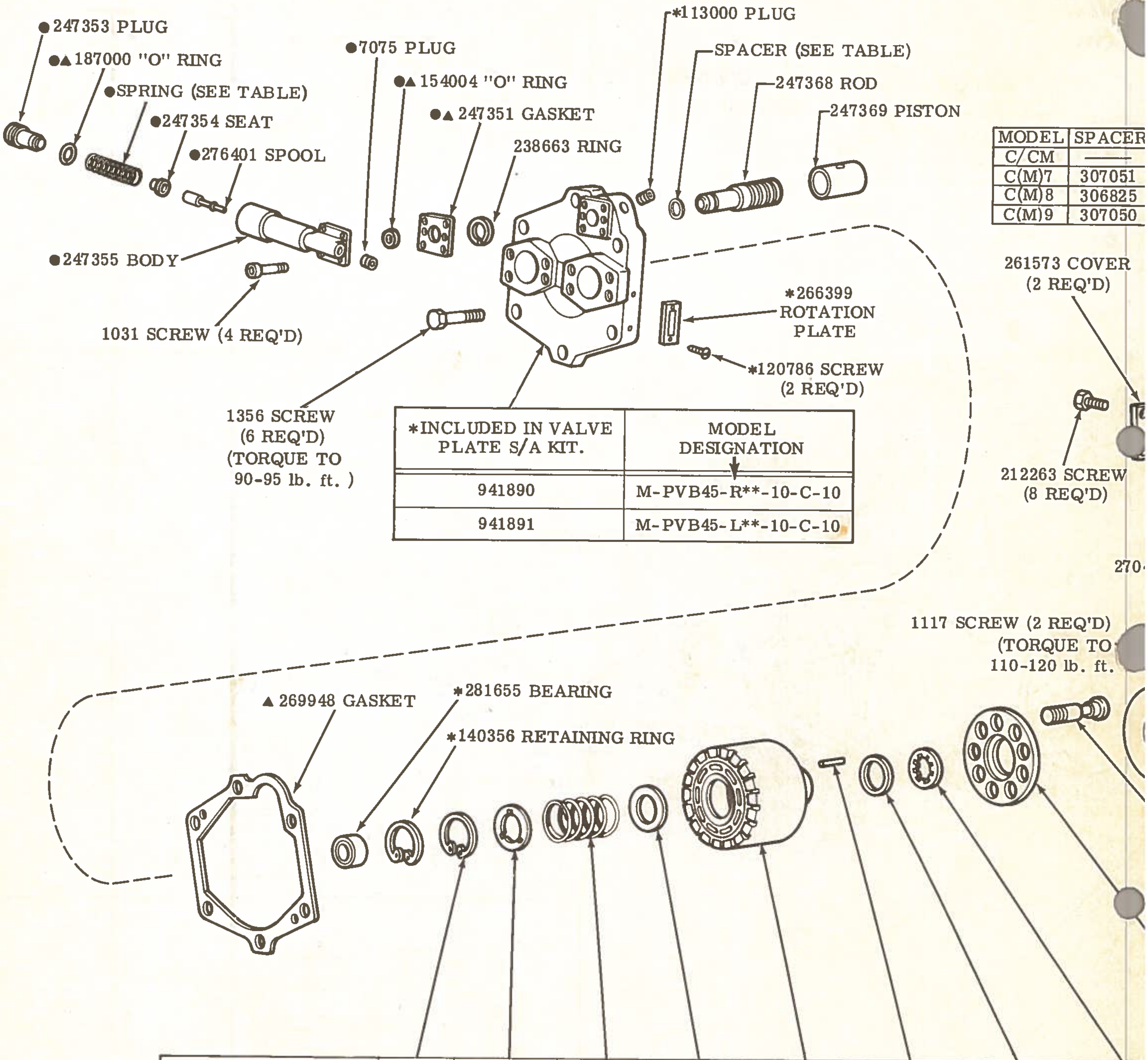


MODEL DESIGNATION	SHAFT	KEY
M-PVB*-**F-10-*10	247371	247101
M-PVB*-**E-10-*10	318548	———

HOE LATE	PISTON KIT (9 PISTONS)	SWASH PLATE	ROTATING GROUP KIT
66112	923189	241543	938286



ASSEMBLY VIEW



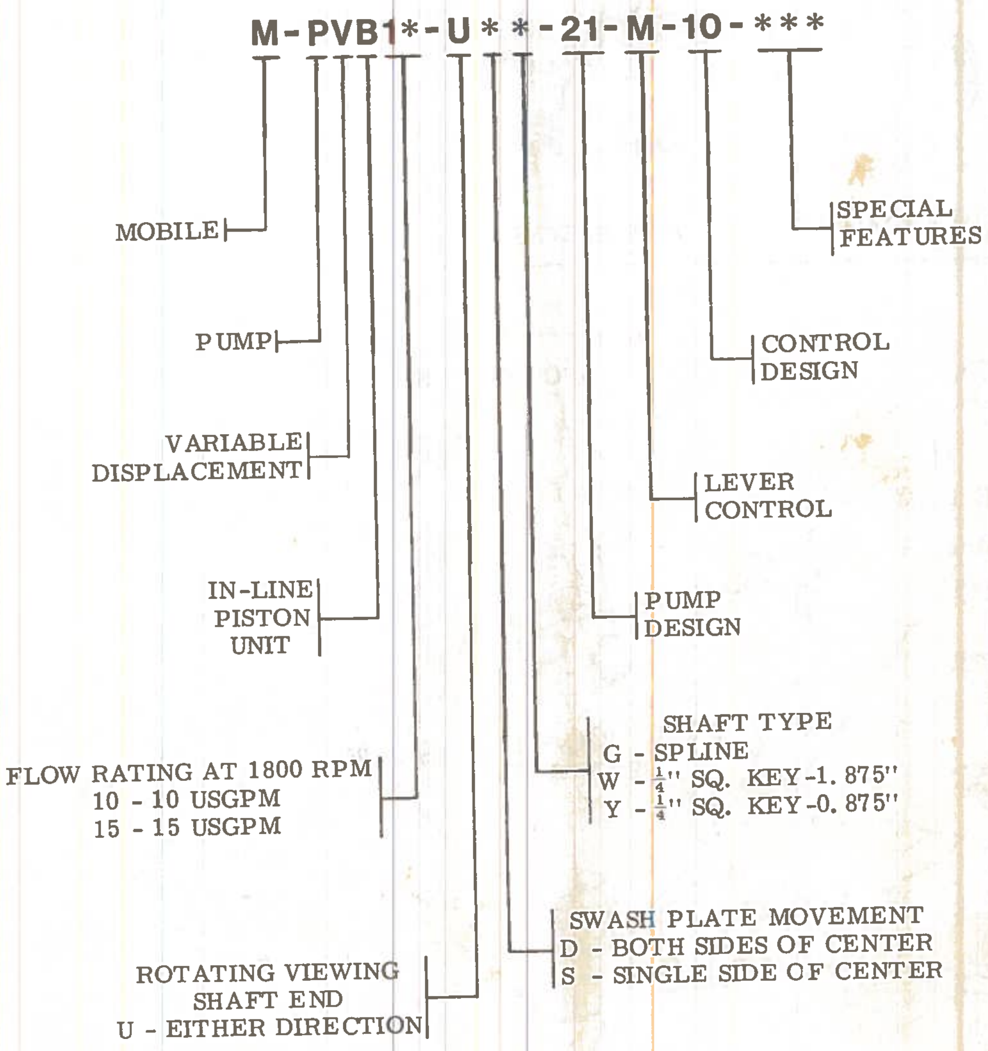
MODEL	SPACER
C/CM	———
C(M)7	307051
C(M)8	306825
C(M)9	307050

*INCLUDED IN VALVE PLATE S/A KIT.	MODEL DESIGNATION
941890	M-PVB45-R**-10-C-10
941891	M-PVB45-L**-10-C-10

MODEL DESIGNATION	RET. RING	LIFT LIMITER	SPRING	THRUST WASHER	CYLINDER BLOCK	PIN (5 REQ'D)	WASHER	SPHERI WASH
	THESE PARTS SERVICED IN ROTATING GR							
M-PVB45***-10-*-10	126911	246017	282557	253665	344064	248883	253664	24154

MODEL CODE BREAKDOWN

M-PVB1*-U-21-M-10-*****



MOBILE

PUMP

VARIABLE DISPLACEMENT

IN-LINE PISTON UNIT

FLOW RATING AT 1800 RPM
10 - 10 USGPM
15 - 15 USGPM

ROTATING VIEWING SHAFT END
U - EITHER DIRECTION

SWASH PLATE MOVEMENT
D - BOTH SIDES OF CENTER
S - SINGLE SIDE OF CENTER

SHAFT TYPE
G - SPLINE
W - $\frac{1}{4}$" SQ. KEY-1.875"
Y - $\frac{1}{4}$" SQ. KEY-0.875"

PUMP DESIGN

LEVER CONTROL

CONTROL DESIGN

SPECIAL FEATURES

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

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Service Parts Information

**Variable
Inline
Piston
Pumps**

M-PVB29 - 11 Design

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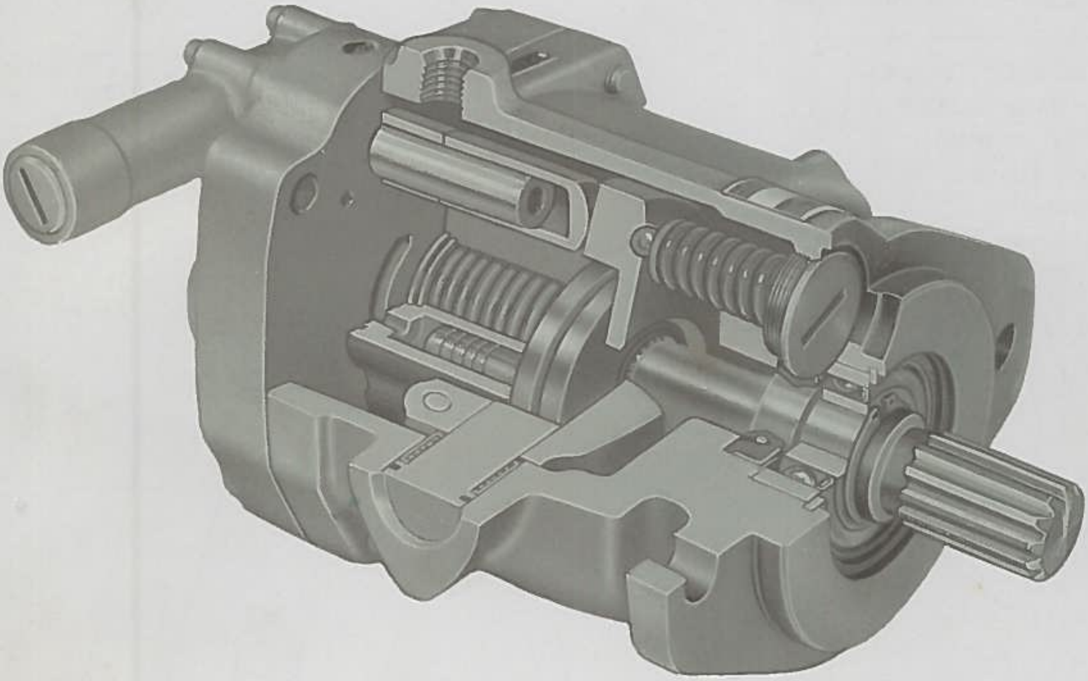

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Revised 12-1-87

M-2215-S

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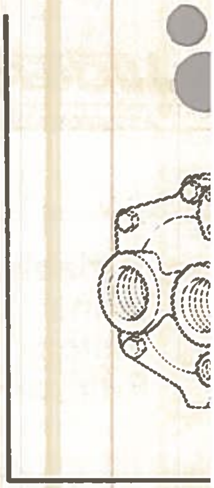
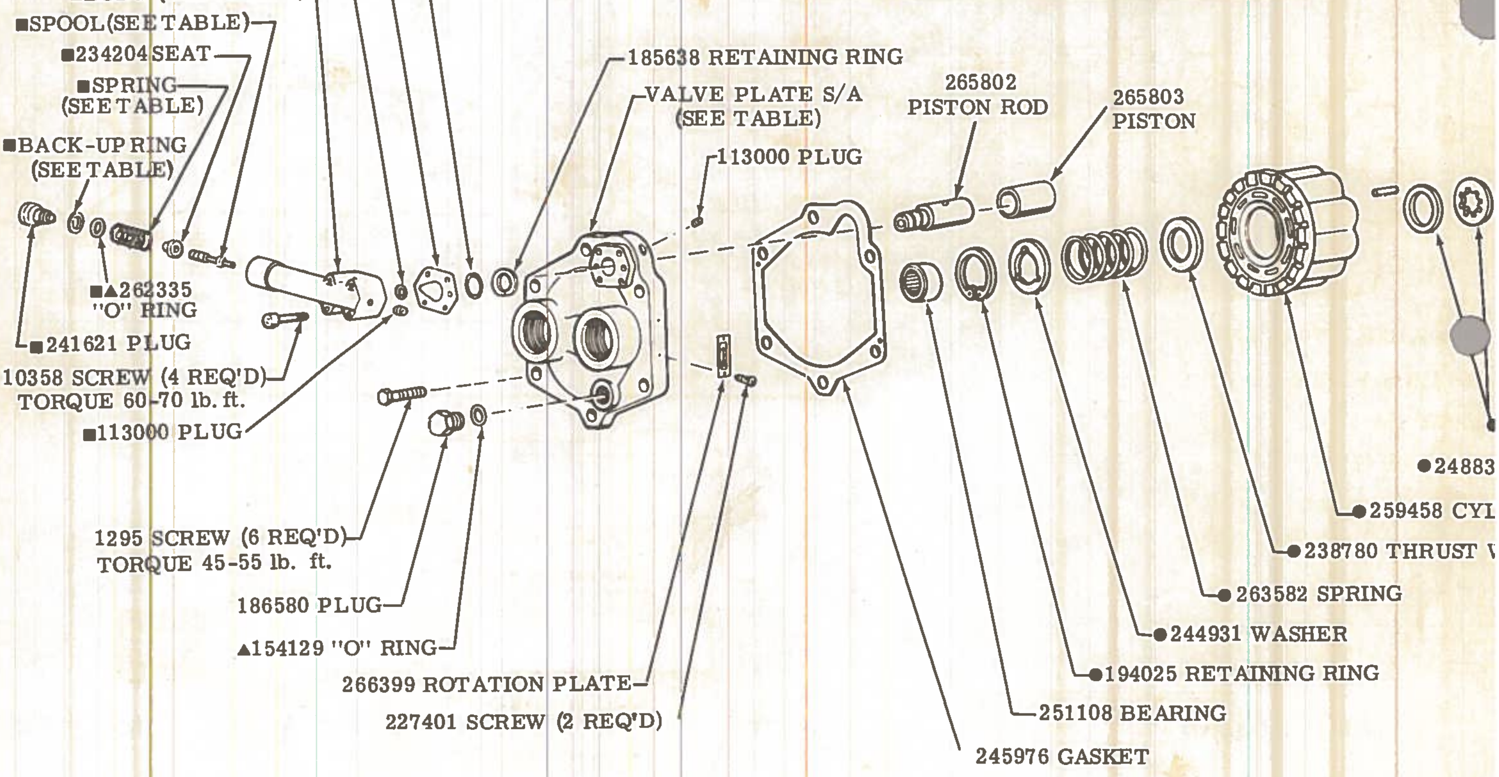
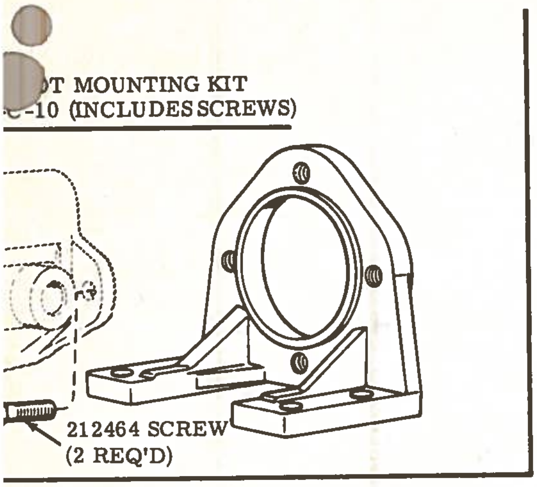


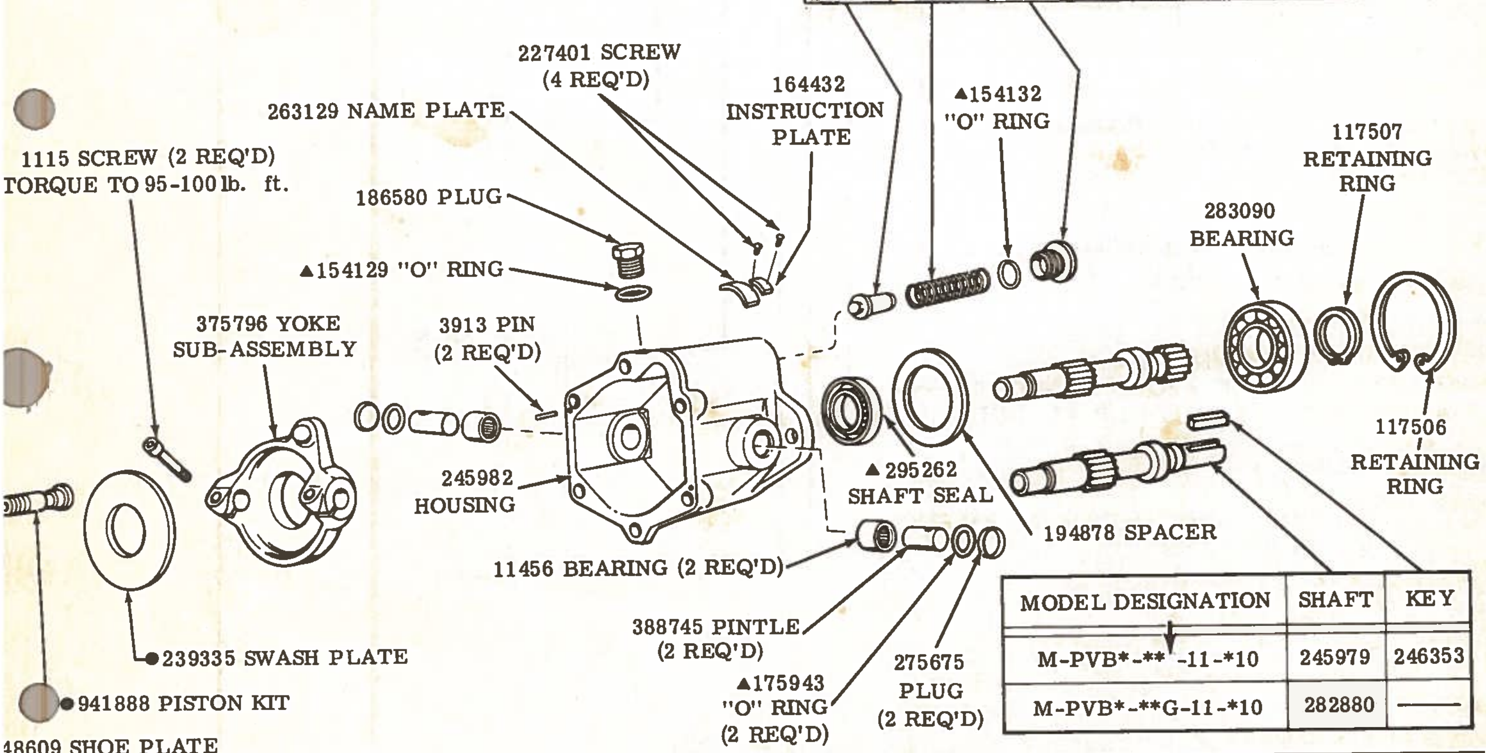
CONTROL TYPE	BODY	SPOOL	BACK-UP RING	PLUG	WIRE	SEAL	SPRING	COMP. KIT
C	241568	241717	————	241621	———	———	239371	941700
CR		285624						923990
CG	412890	296234	197573	412940	17077	17079		942480
CV		278711					417649	942441
■INCLUDED IN COMPENSATOR KIT								

*CAUTION
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJUSTING PLUG.

MODEL DESIGNATION	VALVE PLATE SUB-ASSY. INC. 251108 BEARING
M-PVB29-R**-11-C-10	938404
M-PVB29-L**-11-C-10	938405





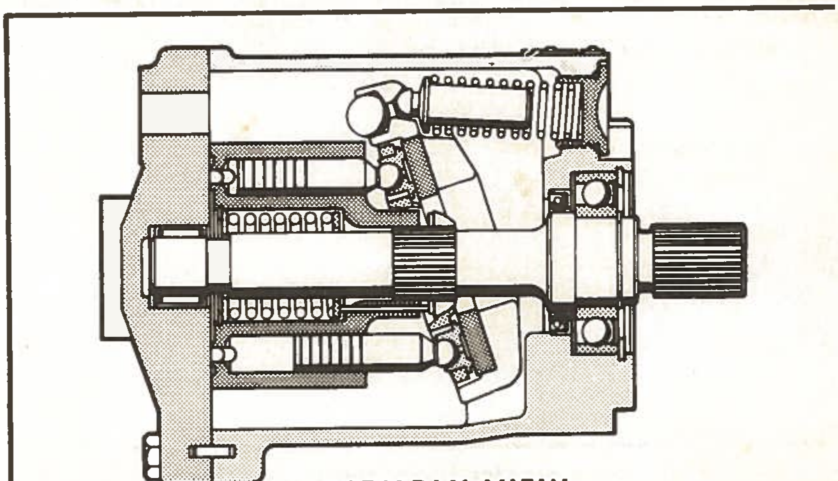


SEAT	SPRING	PLUG	MODEL DESCRIPTION
245975	436335	245973	M-PVB29-***-11-C-10
245975	436335	245973	M-PVB29-***-11-CG-10
306370	306434	306369	M-PVB29-***-11-CR-10
245975	436335	245973	M-PVB29-***-11-CV-10

MODEL DESIGNATION	SHAFT	KEY
M-PVB*-** -11-*10	245979	246353
M-PVB*-**G-11-*10	282880	———

●INCLUDED IN 938290
ROTATING GROUP KIT

▲ = SERVICED IN 923006 SEAL KIT



ASSEMBLY VIEW

MODEL CODE BREAKDOWN

M-PVB 29-(*)* *-11-C*-*0-* * *

MOBILE

PUMP

VARIABLE
DISPLACEMENT

PISTON TYPE
IN-LINE

FLOW RATING @ 1800 RPM
29-29 USGPM

MOUNTING
F - FOOT BRACKET
(OMIT FOR FLANGE)

ROTATION (VIEWED FROM SHAFT END)
R - RIGHT HAND
L - LEFT HAND

SHAFT TYPE
G - SPLINED
(OMIT FOR KEYED SHAFT)

PUMP DESIGN
NUMBER

CONTROL
C - COMPENSATOR CONTROL
CG - REMOTE ADJUSTMENT
CR - DIFFERENTIAL CUTOFF
CV - LOAD SENSING

CONTROL DESIGN
C - 10
CG - 20
CR - 10
CV - 20

SPECIAL FEATURES

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

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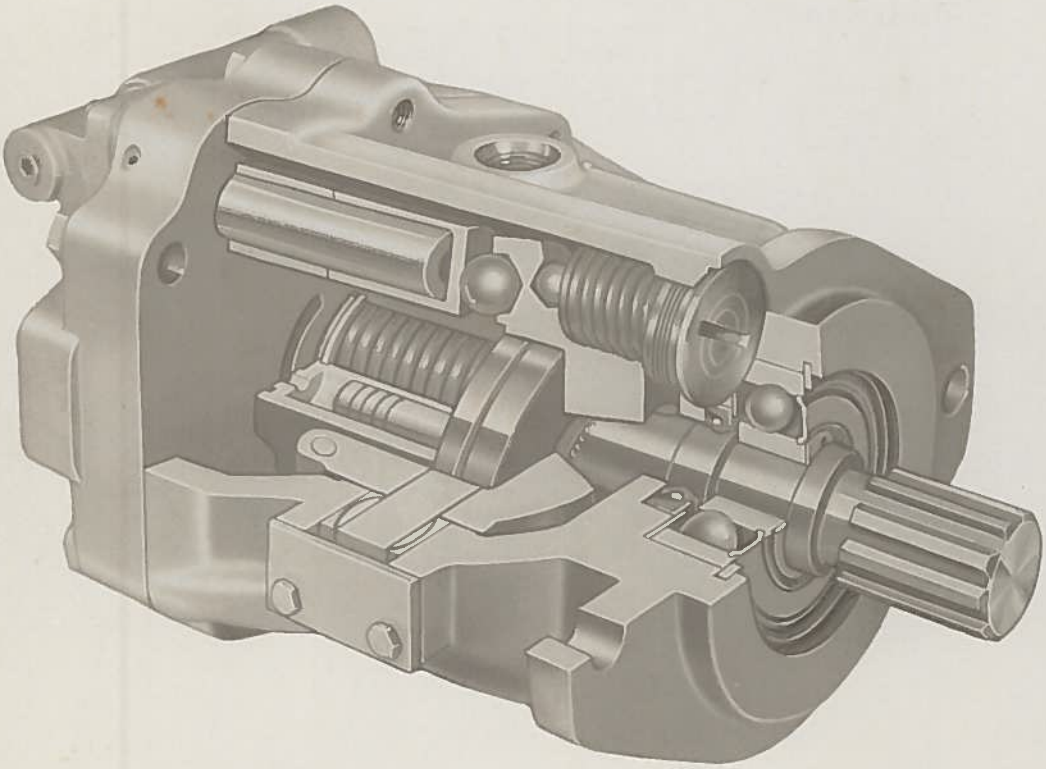
Service Parts Information

Variable
Inline
Piston
Pumps

M-PVB45 - 10 Design

44



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M-2214-S

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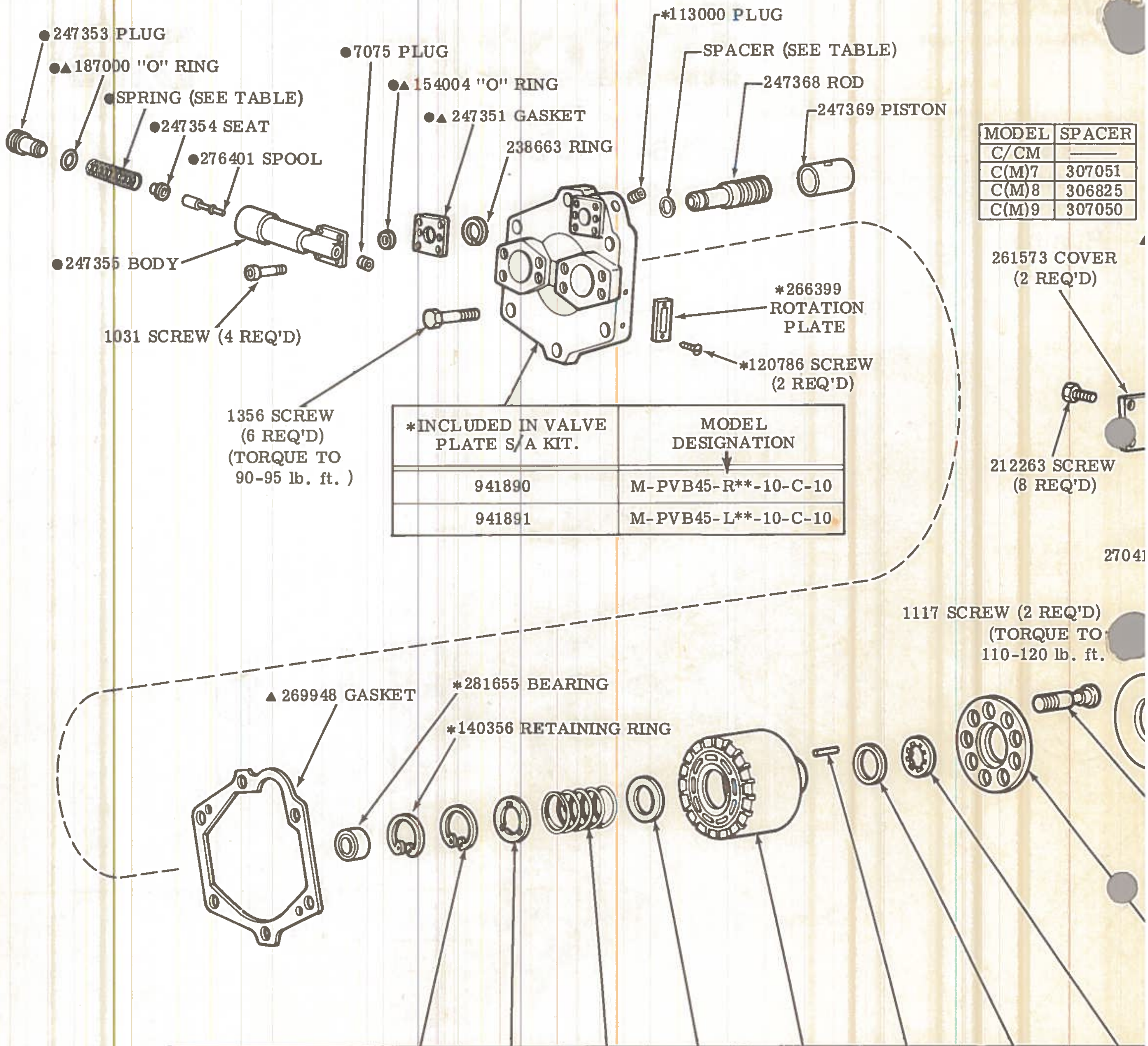


MODEL	SPACER
C/CM	———
C(M)7	307051
C(M)8	306825
C(M)9	307050

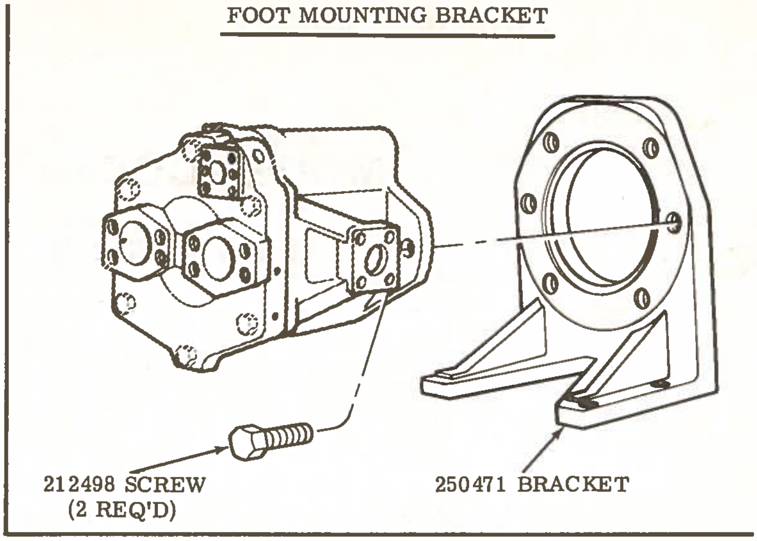
*INCLUDED IN VALVE PLATE S/A KIT.	MODEL DESIGNATION
941890	M-PVB45-R**-10-C-10
941891	M-PVB45-L**-10-C-10

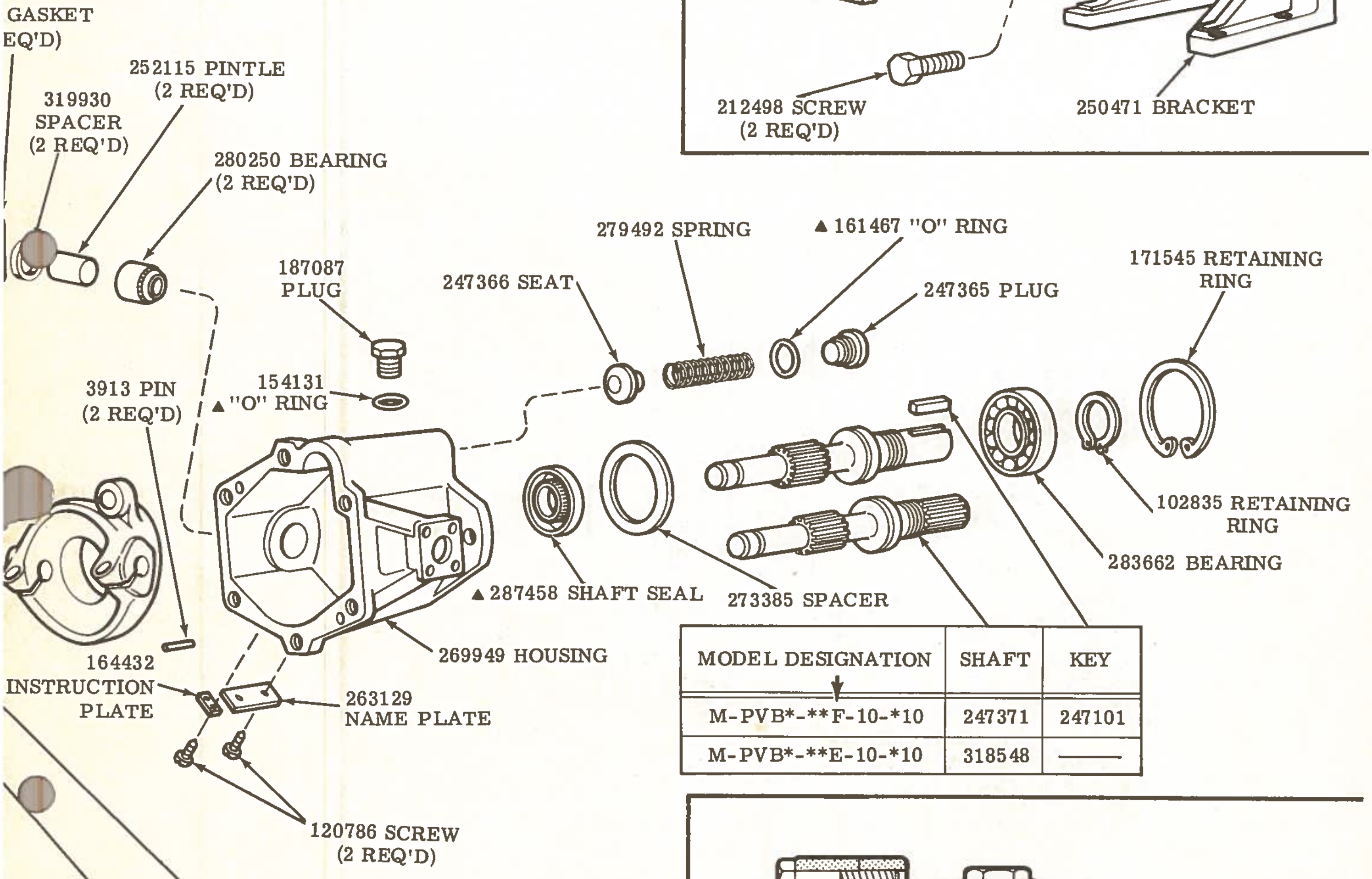
MODEL DESIGNATION	RET. RING	LIFT LIMITER	SPRING	THRUST WASHER	CYLINDER BLOCK	PIN (5 REQ'D)	WASHER	SPHERIC WASHE
	THESE PARTS SERVICED IN ROTATING GR							
M-PVB45***-10-*-10	126911	246017	282557	253665	344064	248883	253664	241541

●INCLUDED IN COMPENSATOR KIT

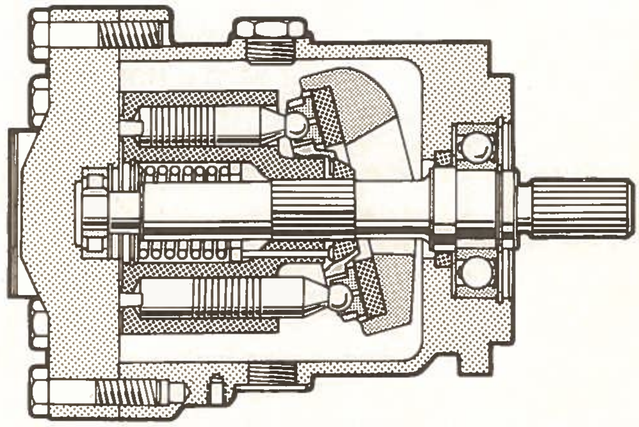
COMPENSATOR ●TYPE	SPRING	COMPENSATOR KIT
C	245087	941744
CM	285870	941745

FOOT MOUNTING BRACKET





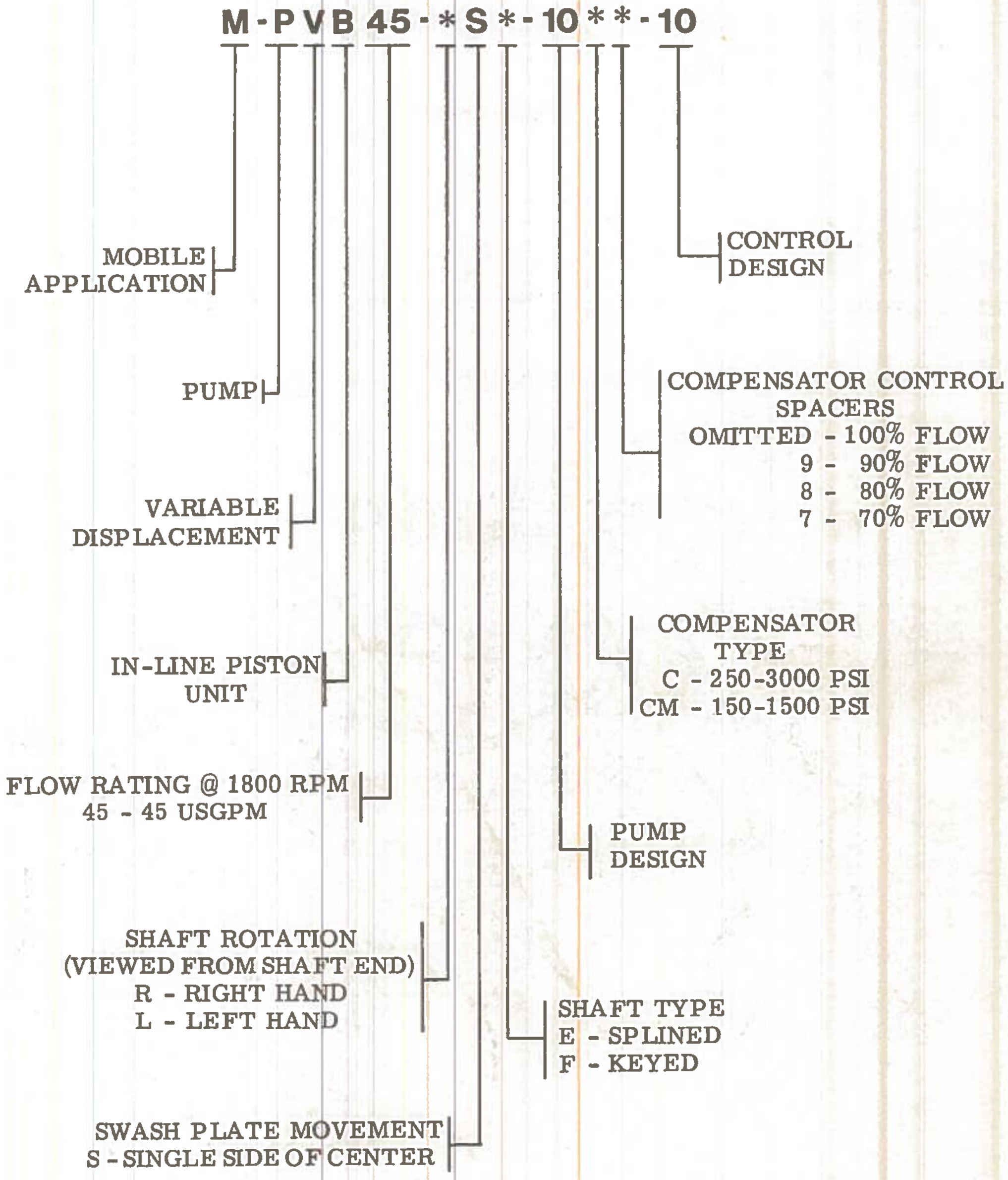
MODEL DESIGNATION	SHAFT	KEY
M-PVB*-**F-10-*10	247371	247101
M-PVB*-**E-10-*10	318548	———



ASSEMBLY VIEW

HOE LATE	PISTON KIT (9 PISTONS)	SWASH PLATE	ROTATING GROUP KIT
66112	923189	241543	938286

MODEL CODE BREAKDOWN



M-PVB45-*S*-10-10**

MOBILE APPLICATION

PUMP

VARIABLE DISPLACEMENT

IN-LINE PISTON UNIT

FLOW RATING @ 1800 RPM
45 - 45 USGPM

SHAFT ROTATION
(VIEWED FROM SHAFT END)
R - RIGHT HAND
L - LEFT HAND

SWASH PLATE MOVEMENT
S - SINGLE SIDE OF CENTER

SHAFT TYPE
E - SPLINED
F - KEYED

PUMP DESIGN

COMPENSATOR TYPE
C - 250-3000 PSI
CM - 150-1500 PSI

COMPENSATOR CONTROL SPACERS
OMITTED - 100% FLOW
9 - 90% FLOW
8 - 80% FLOW
7 - 70% FLOW

CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

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Service Parts Information

Variable Inline Piston Pumps

M-PVB20
M-PVB29
10 Design

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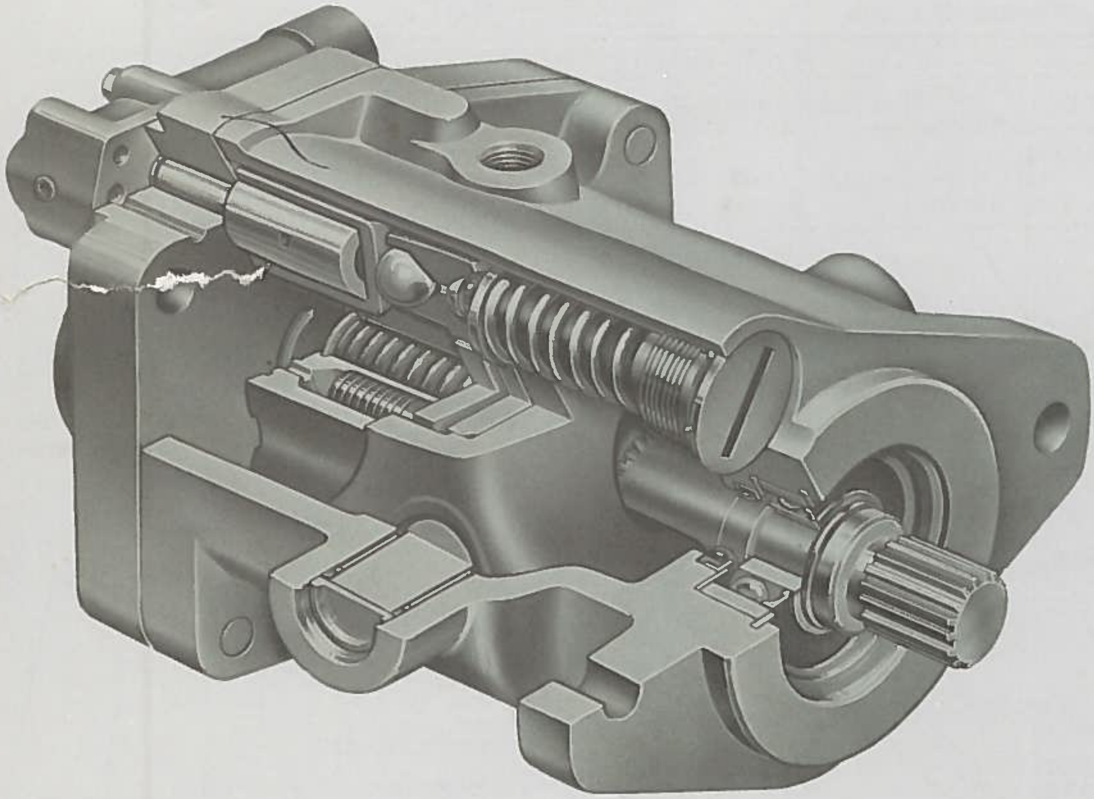

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M-2213-S

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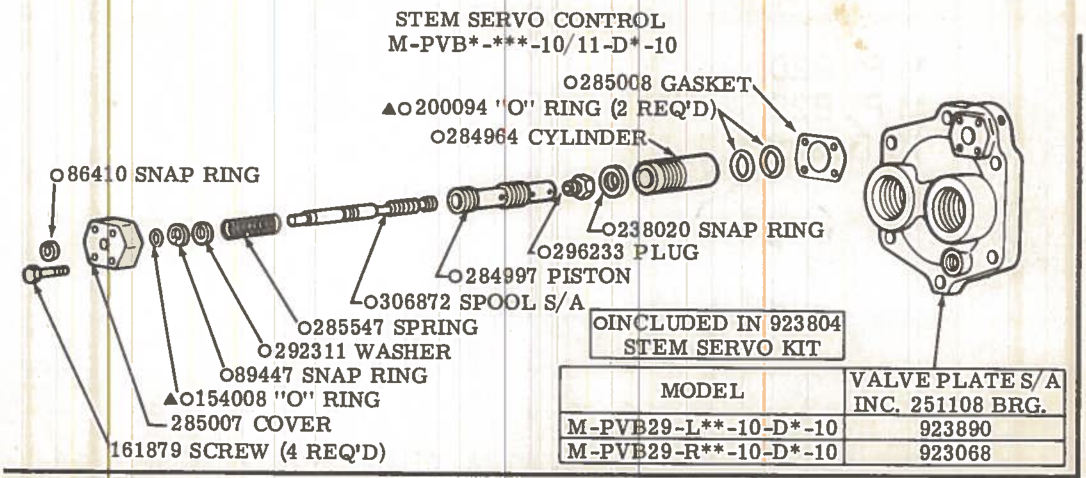
WARNING: USE THIS DRAWING FOR PARTS INFORMATION ONLY. SEE OVERHAUL MANU

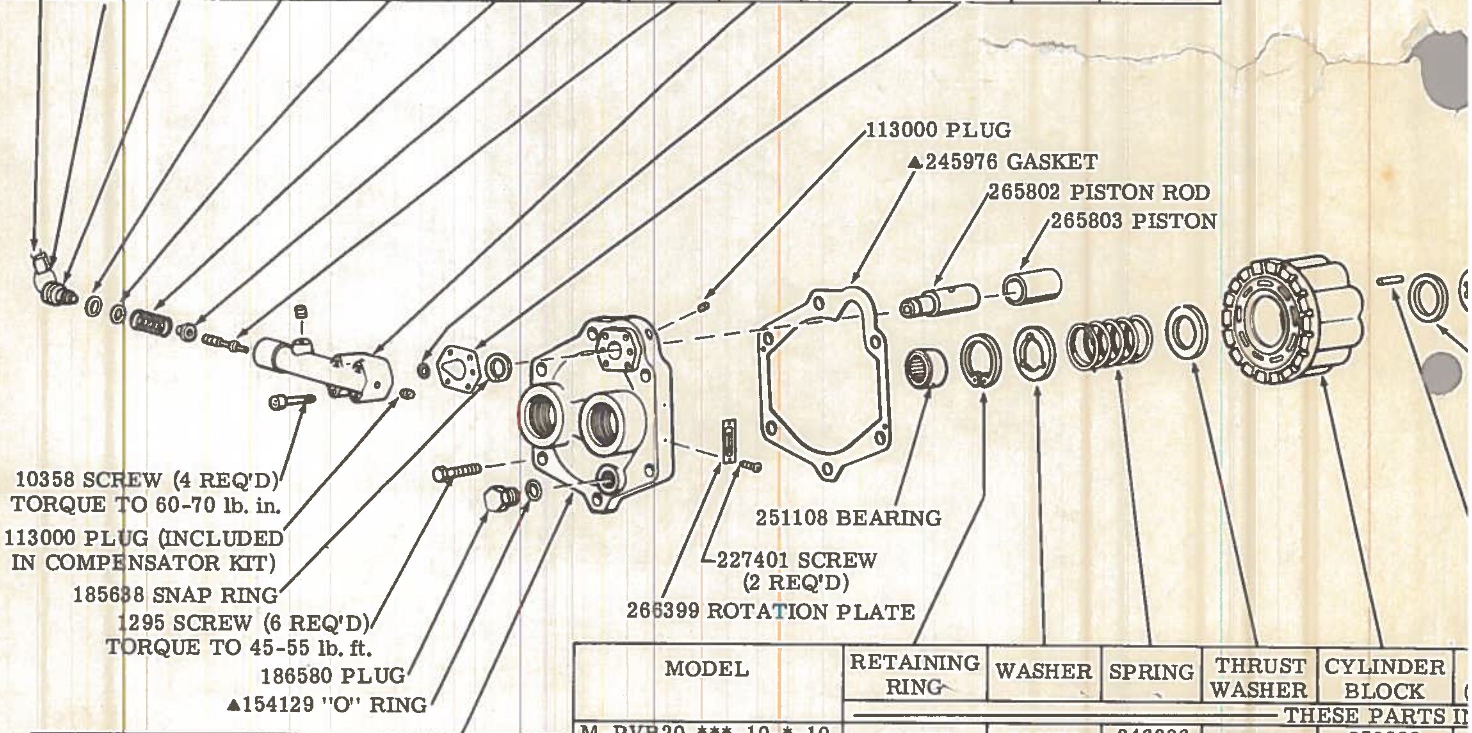
STEM SERVO CONTROL
M-PVB*-***-10/11-D*-10



oINCLUDED IN 923804
STEM SERVO KIT

MODEL	VALVE PLATE S/A INC. 251108 BRG.
M-PVB29-L**-10-D*-10	923890
M-PVB29-R**-10-D*-10	923068

INCLUDED IN COMPENSATOR SUBASSEMBLY KIT												
SEAL	SEAL WIRE	PLUG	BACK UP ▲RING	▲ "O" RING	SPRING	SEAT	SPOOL	BODY	▲ "O" RING	GASKET	COMP. KIT	CONTROL
——	——	241621	——	262335	239371	234204	241717	241568	154005	244956	941700	C
							285624				923990	CR
17079	17077	412940	197573				296234	412890			942480	CG
					417649		278711				942441	CV

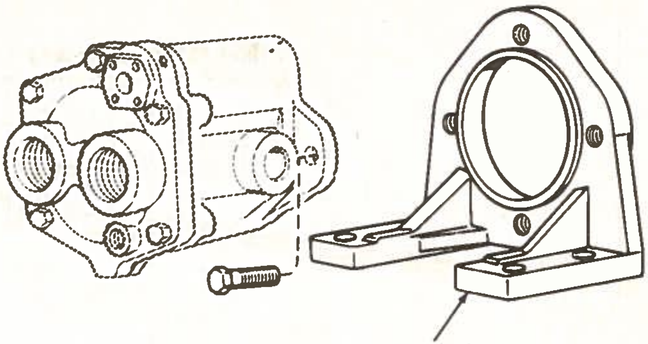


MODEL	RETAINING RING	WASHER	SPRING	THRUST WASHER	CYLINDER BLOCK
	THESE PARTS I				
M-PVB20-***-10-*-10	194025	244931	246386	238780	250688
M-PVB29-***-10-*-10			263582		259458

MODEL	VALVE PLATE S/A INC. 251108 BEARING
M-PVB20-R**-10-C-10	938400
M-PVB20-L**-10-C-10	938401
M-PVB29-R**-10-C-10	938404
M-PVB29-L**-10-C-10	938405

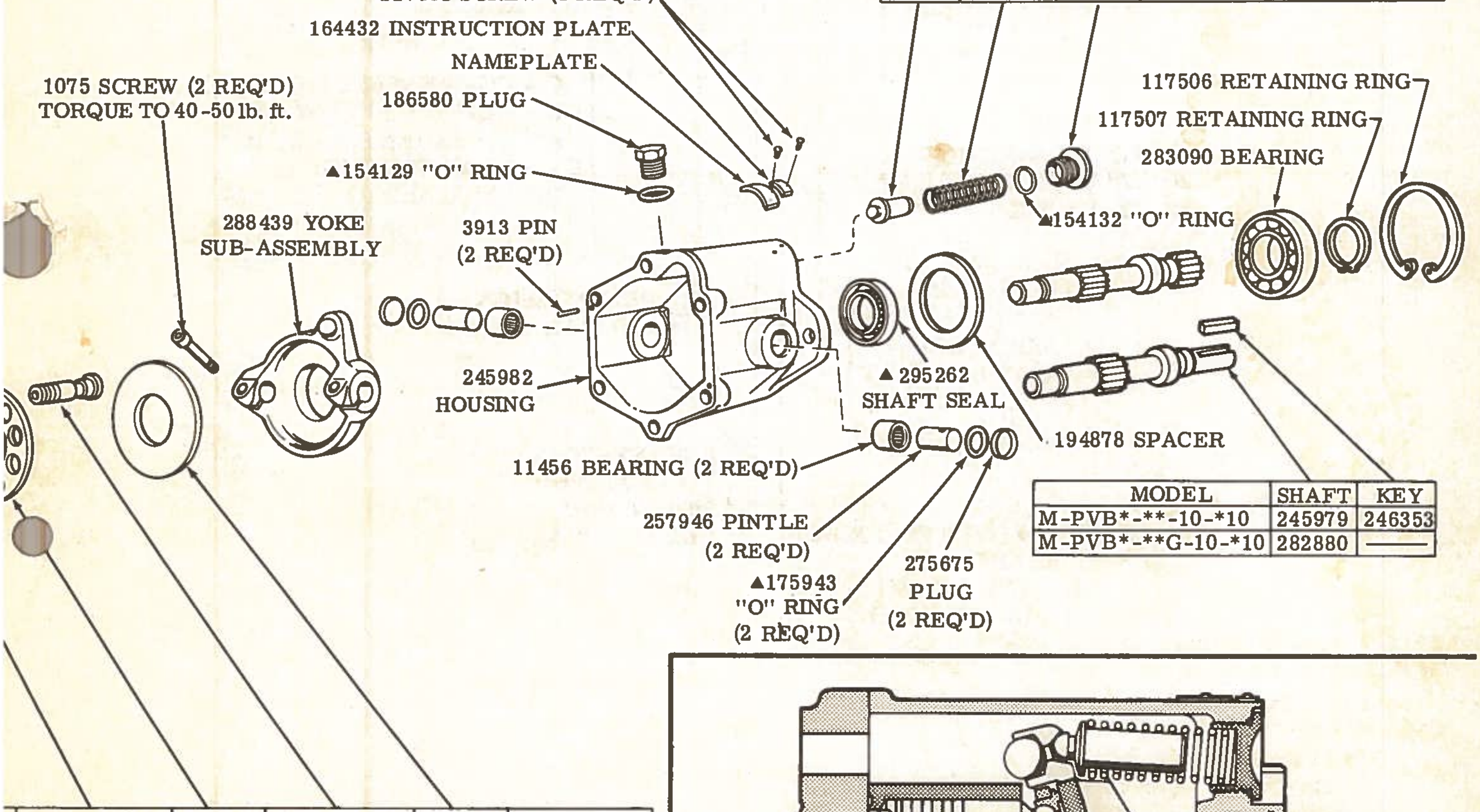
MAINTENANCE INFORMATION

FOOT MOUNTING BRACKET KIT



FB-C-10
(INCLUDES SCREWS)

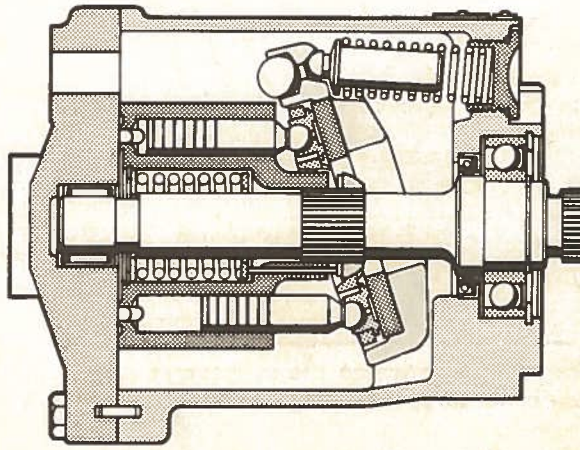
SEAT	SPRING	PLUG	MODEL
245975	436335	245973	M-PVB2*-***-11-C/CG-*0
306370	306434	306369	M-PVB2*-***-11-CR-10
245975	436335	245973	M-PVB2*-***-11-CV/D-*0



MODEL	SHAFT	KEY
M-PVB*-**-10-*10	245979	246353
M-PVB*-**G-10-*10	282880	——

	SPHERICAL WASHER S/A	SHOE PLATE	PISTON KIT (9 PISTONS)	SWASH PLATE	ROTATING GROUP KIT
IN ROTATING GROUP KIT					
	938392	248609	941883	239335	938280
			941888		938290

▲INCLUDED IN
923006 SEAL KIT



MODEL CODE BREAKDOWN

M-PVB 2*-(*) * * - 10 - ** -*0 ***

MOBILE

PUMP

VARIABLE DISPLACEMENT

PISTON TYPE IN-LINE

FLOW RATING @ 1800 RPM
20 - 20 USGPM
29 - 29 USGPM

MOUNTING
F - FOOT BRACKET
(OMIT FOR FLANGE)

ROTATION (VIEWED FROM SHAFT END)
L - LEFT HAND
R - RIGHT HAND

SHAFT TYPE
G - SPLINED
(OMIT FOR KEYED SHAFT)

PUMP DESIGN NUMBER

CONTROL
C - COMPENSATOR CONTROL
CG - REMOTE ADJUSTMENT
CR - DIFFERENTIAL CUTOFF
CV - LOAD SENSING
D - STEM SERVO

CONTROL DESIGN
C - 10
CG - 20
CR - 10
CV - 20
D - 10

SPECIAL FEATURES

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

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VICKERS®
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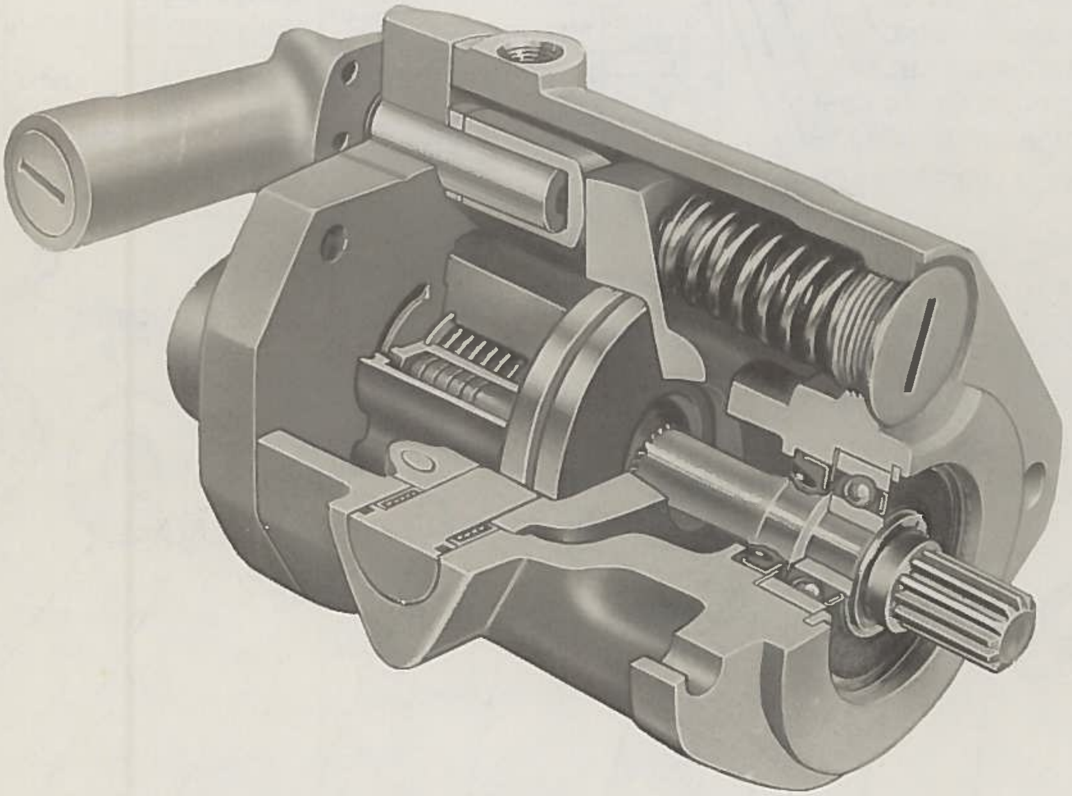
Service Parts Information

Variable Inline Piston Pumps

M-PVB10 & M-PVB15 -21 Design
Compensated Units

46



Vickers, Incorporated

1401 Crooks Road
Troy, Michigan 48084

Revised 12-1-87 **M-2212-S**

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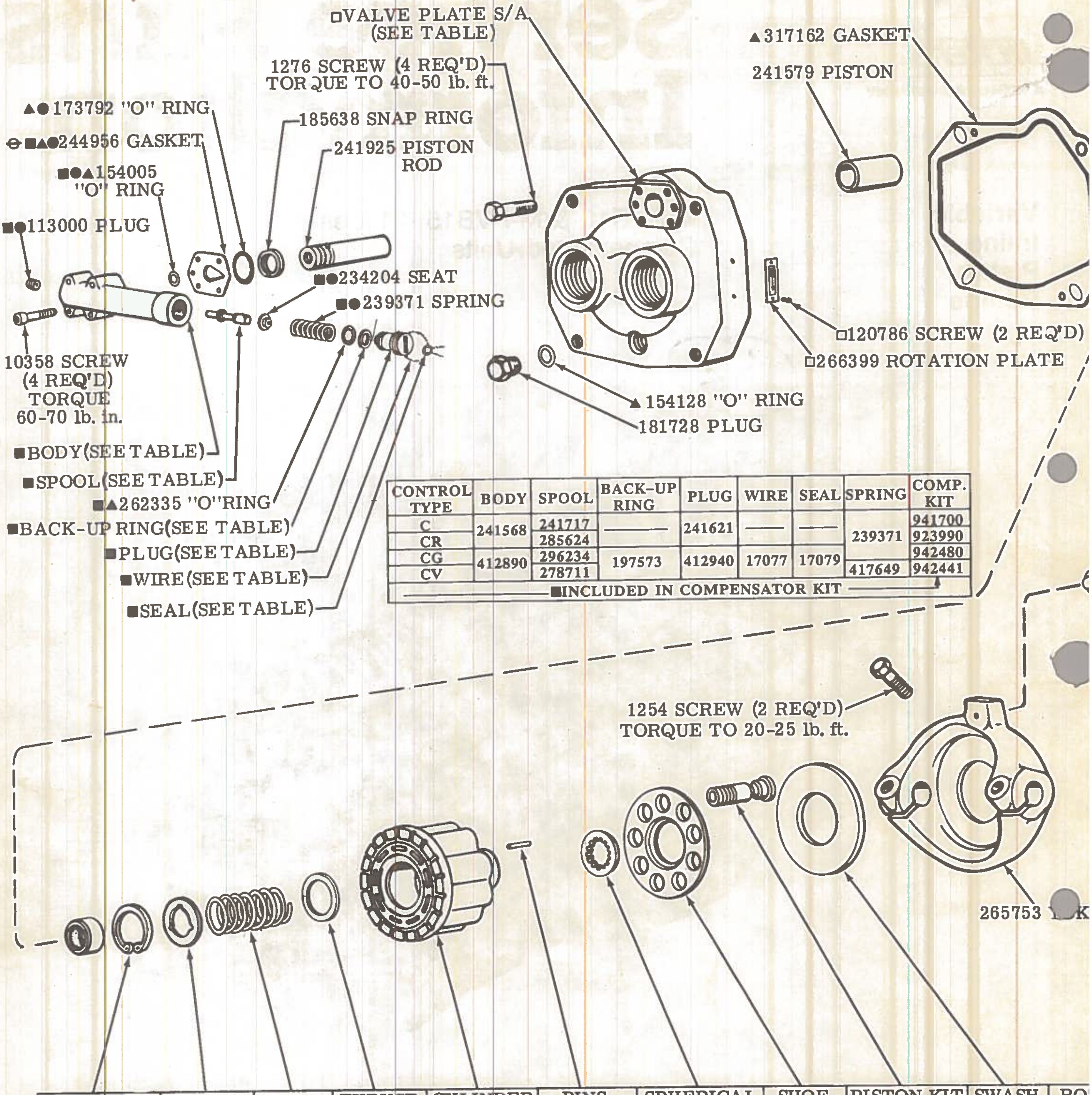
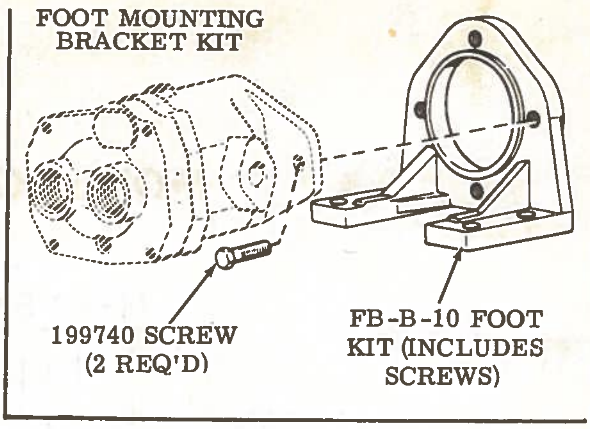


CONTROL TYPE	BODY	SPOOL	BACK-UP RING	PLUG	WIRE	SEAL	SPRING	COMP. KIT
C	241568	241717	———	241621	———	———	239371	941700
CR		285624						923990
CG	412890	296234	197573	412940	17077	17079		942480
CV		278711					417649	942441
■INCLUDED IN COMPENSATOR KIT								

RETAINING RING	LIFT LIMITER	SPRING	THRUST WASHER	CYLINDER BLOCK	PINS (3 REQ'D)	SPHERICAL WASHER	SHOE PLATE	PISTON KIT (9 PISTONS)	SWASH PLATE	RO GRO
THESE PARTS ARE SERVICED IN ROTATING GROUP KIT										
93509	245223	247294	241954	321703 260860	248811	423324	275961	942047 941887	239077	9 9

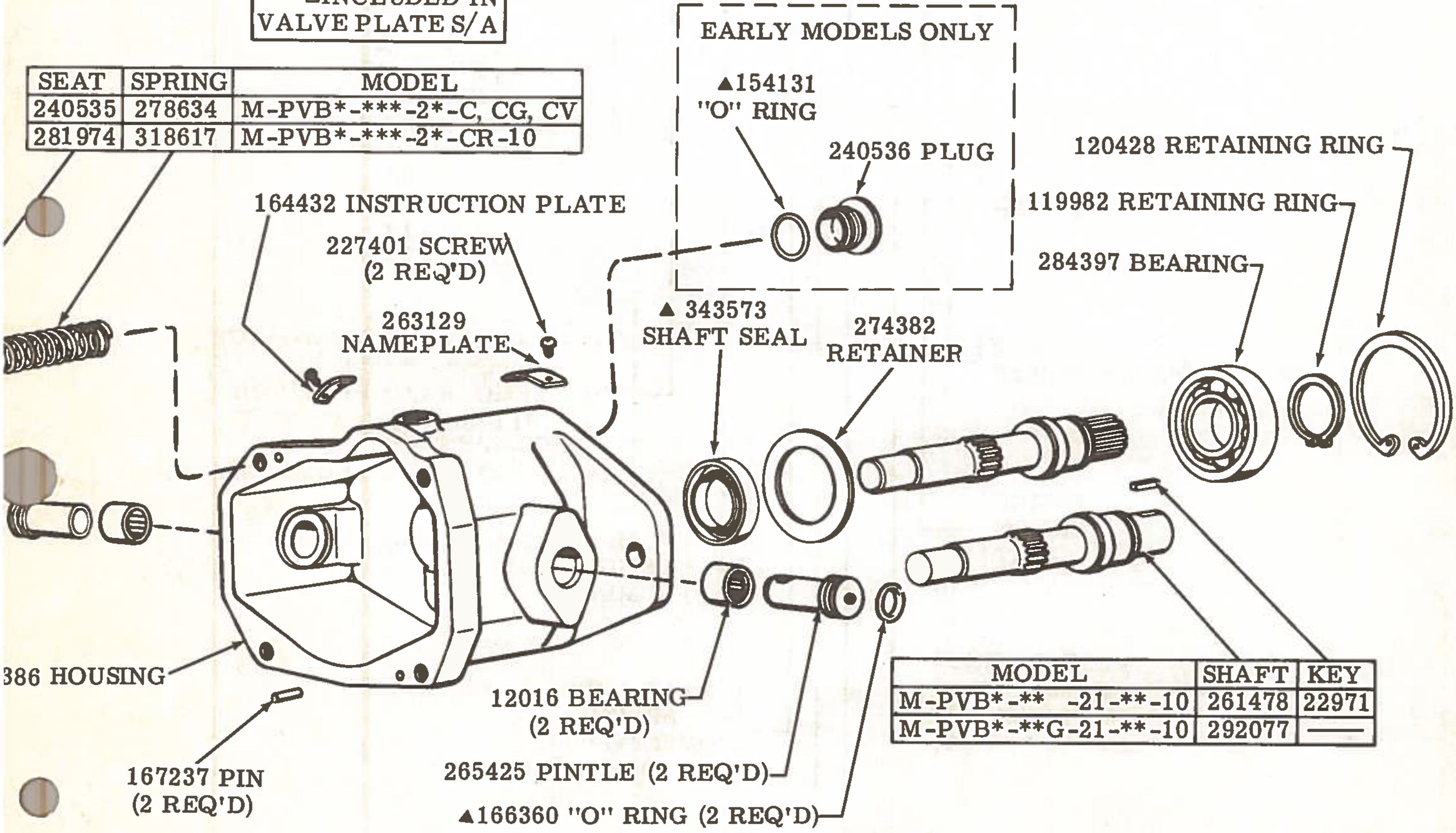
⊖CAUTION
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJ. PLUG.

□VALVE PLATE S/A INCLUDES 12016 BEARING	MODEL
938386	M-PVB10-R**-21-C(*)-*0
938385	M-PVB10-L**-21-C(*)-*0
938378	M-PVB15-R**-21-C(*)-*0
938377	M-PVB15-L**-21-C(*)-*0



□INCLUDED IN VALVE PLATE S/A

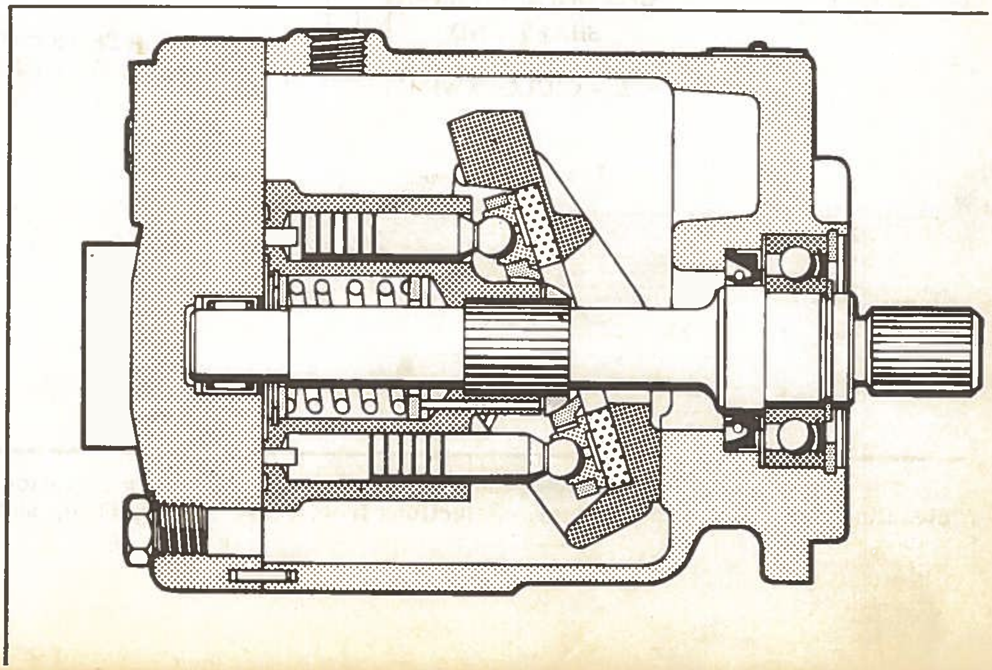
SEAT	SPRING	MODEL
240535	278634	M-PVB*-***-2*-C, CG, CV
281974	318617	M-PVB*-***-2*-CR-10



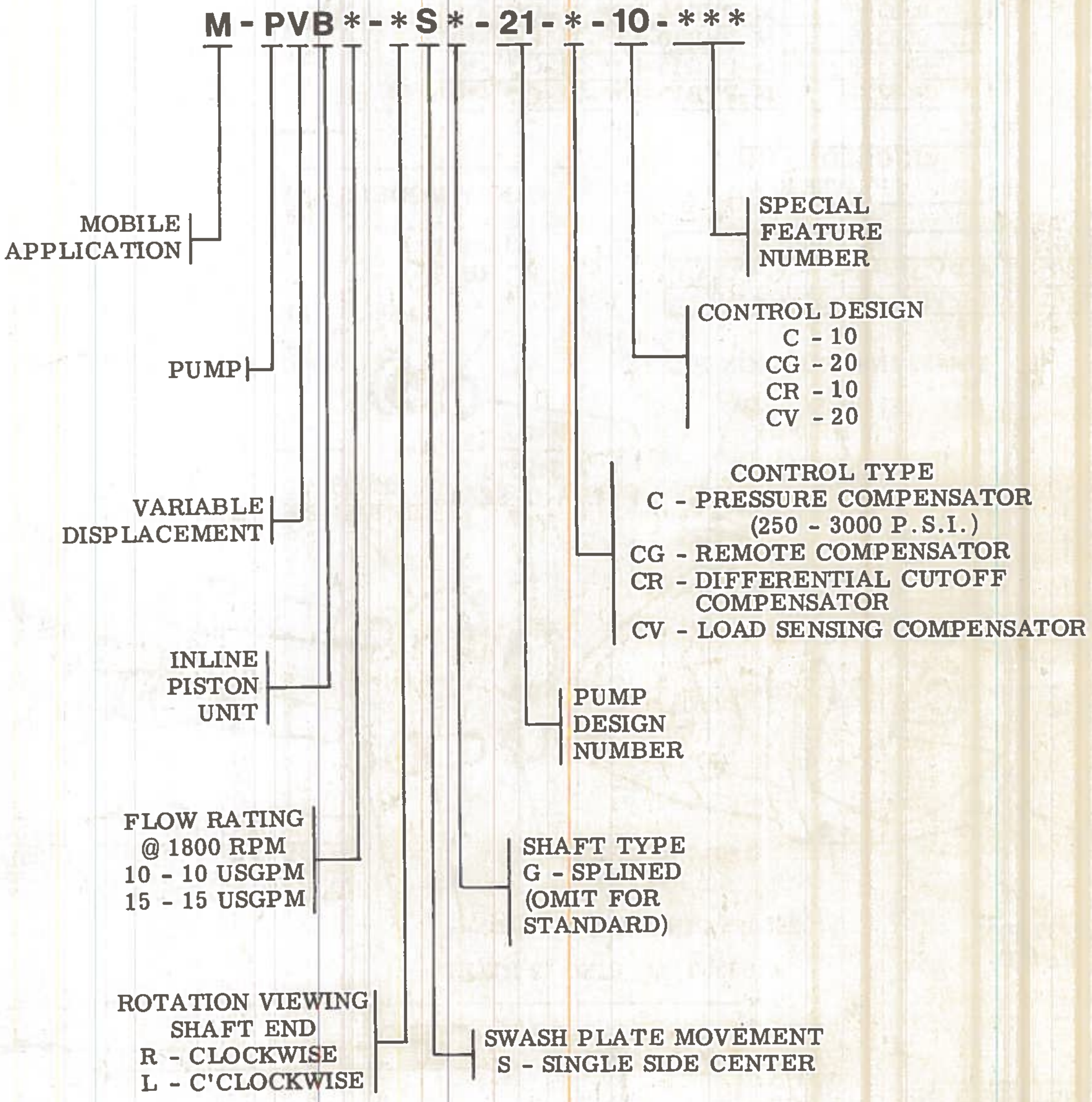
MODEL	SHAFT	KEY
M-PVB*-** -21-**-10	261478	22971
M-PVB*-**G-21-**-10	292077	——

▲INCLUDED IN SEAL KIT 919192

	MODEL
	M-PVB10-***-21-**-*0
	M-PVB15-***-21-**-*0



MODEL CODE BREAKDOWN



M - PVB * - * S * - 21 - * - 10 - * * *

MOBILE
APPLICATION

PUMP

VARIABLE
DISPLACEMENT

INLINE
PISTON
UNIT

FLOW RATING
@ 1800 RPM
10 - 10 USGPM
15 - 15 USGPM

ROTATION VIEWING
SHAFT END
R - CLOCKWISE
L - C'CLOCKWISE

SWASH PLATE MOVEMENT
S - SINGLE SIDE CENTER

SHAFT TYPE
G - SPLINED
(OMIT FOR
STANDARD)

PUMP
DESIGN
NUMBER

CONTROL TYPE
C - PRESSURE COMPENSATOR
(250 - 3000 P.S.I.)
CG - REMOTE COMPENSATOR
CR - DIFFERENTIAL CUTOFF
COMPENSATOR
CV - LOAD SENSING COMPENSATOR

CONTROL DESIGN
C - 10
CG - 20
CR - 10
CV - 20

SPECIAL
FEATURE
NUMBER

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

Spare parts information
Ersatzteilinformation
Fiche de pièces détachées
Bollettino parti di ricambio

1

VICKERS

Piston pump
Kolbenpumpe
Pompe à pistons
Pompa a pistoni

98

PVH 57 (QI) C-R A F-1-S-10-C 25 VT 18-14

PVH	57	(QI)	C	R	A	F	1	S	10	C	25	VT	18	14
1	2	3	4	5	6	7	8	9	10	11	12	13	13	14

1 PVH Model Series

2 Variable Displacement

57- 57 cc/r

3 Quiet Version

Blank - Mobile version
QI - Quiet industrial

4 Mounting Flange

C - SAE "C" , 4 bolt
M - ISO-3019-2

5 Rotation (Viewed from shaft end)

R - Clockwise rotation
L - Counterclockwise rotation

6 Configuration (see table)

7 Port Connections

F - SAE flange ports
M - Metric flange ports

8 Shaft

1 - SAE C Straight keyed
2 - SAE C Splined
N - ISO 3019-2 Straight keyed

9 Shaft Seal

S - Single
D - Double

10 Pump Design

11 Control Options (see table)

12 Pressure Comp. Setting (Tens of bar)

25 - 250 bar setting (C)
7 - 70 bar setting (CM)

13 Torque Limiter Setting (Tens of bar)

18 - 180 bar
(Must be 30-80 % of Max. pressure compensator setting)

14 Control Design

30 - C/CV
13 - CT
14 - CVT

1 Baureihe PVH

2 Verstellbares Fördervolumen

57- 57 cm^3/u

3 Leise Ausführung

Leer - Mobil-Version
QI - Leise Industrie-Version

4 Bfestigungsflansch

C - SAE "C" , 4 Schrauben
M - ISO-3019-2

5 Drehrichtung (Mit Blick auf Wellenende)

R - Rechtslauf
L - Linkslauf

6 Bauart (siehe tabelle)

7 Systemanschlüsse

F - SAE Flansche
M - Metrische Flansche

8 Welle

1 - SAE "C" zylind. mit Paßfeder
2 - SAE "C" verzahnte Welle
N - ISO 3019-2 zylind. mit Paßfeder

9 Wellendichtung

S - Einzeldichtung
D - Doppeldichtung

10 Seriennummer Pumpe

11 Reglervausführung (siehe tabelle)

12 Reglereinstellung (in 10 bar stufen)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Einstellung Drehmomanbegrenzer (in 10 bar Stufen)

18 - 180 bar
(Muß 30-80 % der max. Reglereinstellung betragen)

14 Seriennummer Regler

30 - C/CV
13 - CT
14 - CVT

1 Série PVH

2 Cylindrée variable

57 - 57 cm^3/tr

3 Version silencieuse

Omis - version mobile
QI - version industrielle silencieuse

4 Bride de montage

C - SAE C à 4 vis
M - ISO-3019-2

5 Sens de rotation (vu du côté arbre)

R - horaire
L - anti-horaire

6 Exécution (Voir le tableau)

7 Raccordement des orifices

F - bride SAE
M - bride métrique

8 Bout d'arbre

1 - cylindrique claveté SAE C
2 - cannelé SAE C
N - ISO 3019-2 cylindrique claveté

9 Joint d'arbre

S - Simple
D - Double

10 Numéro de dessin de pompe

11 Choix de commandes (Voir le tableau)

12 Tarage du compensateur de pression (en dizaines de bar)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Réglage du limiteur de couple (en dizaines de bar)

18 -180 bar
(Obligatoirement 30 à 80% du tarage maxi. de compensateur)

14 Numéro de dessin de la commande

30 - C/CV
13 - CT
14 - CVT

1 Modello serie PVH

2 Cilindrata variabile

57- 57 cc/r

3 Versione silenziosa

Vuoto - versione appl.mobile
QI - Versione silenziosa appl.industriali

4 Flangia di montaggio

C - 4 fori SAE "C"
M - ISO-3019-2

5 Rotazione (vista dal lato albero)

R - Rotazione oraria
C - Rotazione antioraria

6 Configurazione (vedi tabella)

7 Bocche di connessione

F - attacchi flangiati SAE
M - attacchi a flangia metriche

8 Albero

1 - Cilindrico con chiavetta SAE "C"
2 - Scanalato SAE "C"
N - ISO 3019-2 Cilindrico con chiavetta

9 Guarnizione albero

S - Singola
D - Doppia

10 Serie pompa

11 Opzioni sul controllo (vedi tabella)

12 Taratura del compensatore di pressione (in decine di bar)

Pressione di taratura da 25 a 250 bar (C)
Pressione di taratura da 7 a 70 bar (CM)

13 Taratura del limitatore di coppia (in decine di bar)

da 18 a 180 bar
(deve essere compresa dal 30 all'80% del massimo valore tarato sul compensatore)

14 Serie

30 - C/CV
13 - CT
14 - CVT

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Released 8-1-90

6 Configuration

Blank – Non thru drive
A – SAE "A" pad thru drive
B – SAE "B" pad thru drive
C – SAE "C" pad thru drive

6 Bauart

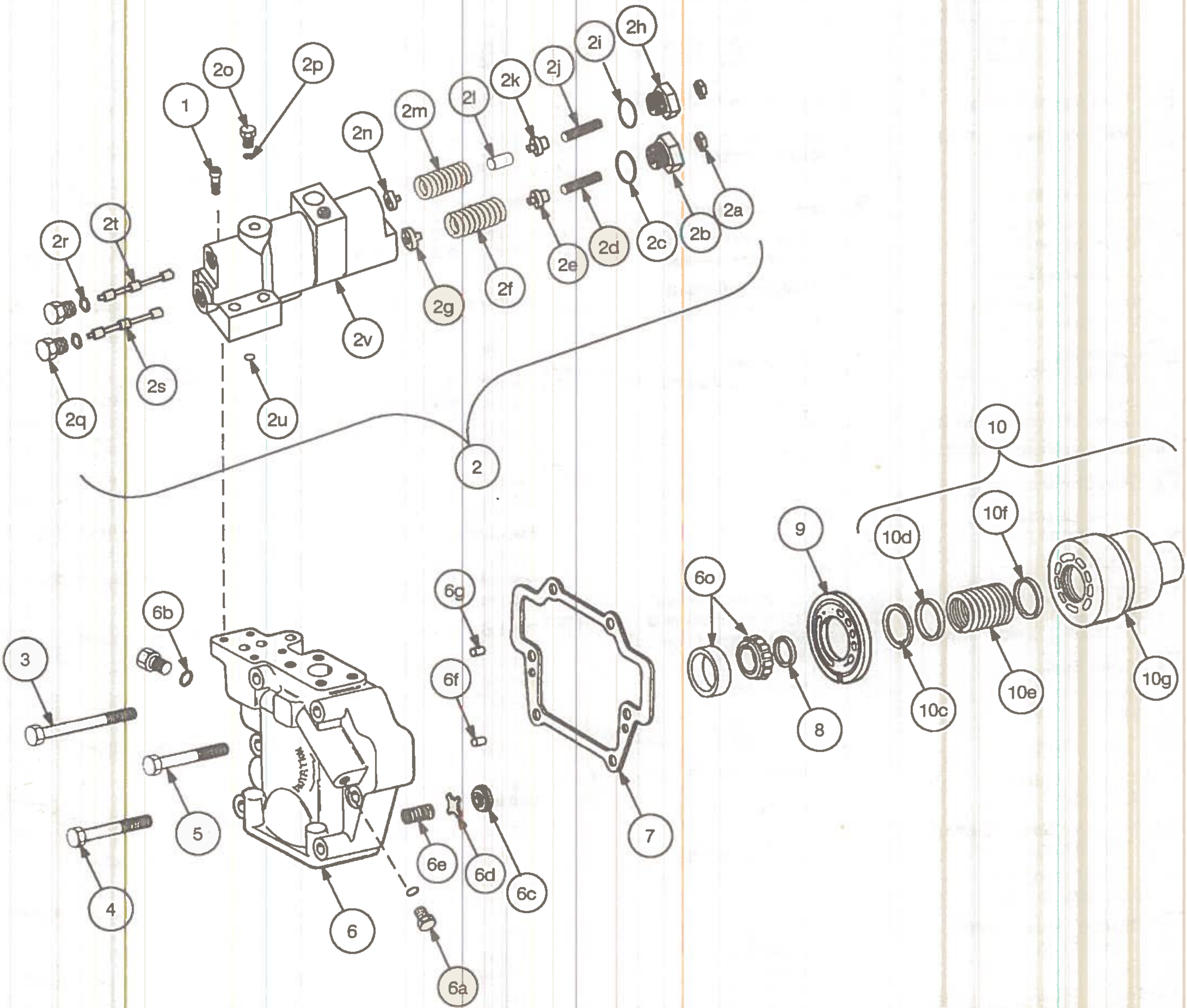
Leer – Ohne durchg. Welle
A – SAE "A" Befestigung für durchg. Welle
B – SAE "B" Befestigung für durchg. Welle
C – SAE "C" Befestigung für durchg. Welle

6 Exécution

Omis – sans entraînement traversant
A – entraînement traversant avec plan de pose SAE A
B – entraînement traversant avec plan de pose SAE B
C – entraînement traversant avec plan de pose SAE C

6 Configurazione

Vuoto – Albero non passante
A – Albero passante con flangia SAE "A"
B – Albero passante con flangia SAE "B"
C – Albero passante con flangia SAE "C"



11 Control Options

C – Pressure Compensator STD.
CM – Pressure Compensator
CV** – Pressure Compensator-with load sensing
CT**** – Pressure Compensator with torque limiter
CVT**** – Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C – Druckregler (Standard)
CM – Druckregler
CV** – Druckregler mit Load sensing
CT**** – Druckregler mit Drehmomentbegrenzer
CVT**** – Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C – compensateur de pression standard
CM – compensateur de pression
CV** – compensateur de pression "load-sensing"
CT**** – compensateur de pression avec limiteur de couple
CVT**** – compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C – Compensatore di pressione standard
CM – Compensatore di pressione
CV** – Compensatore di pressione con rilevatore di carico
CT**** – Compensatore di pressione con limitatore di coppia
CVT**** – compensatore di pressione con limitatore di coppia e rilevatore di carico

Item Pos. Rep. Pos.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
27	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
28	526614	✻	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizio
	864204	✻	Housing (double seal)	Gehäuse (Doppeldichtung)	Carter (joint double)	Corpo (con doppia guarnizio
	883084	✻	Housing (metric single seal)	Gehäuse (Einzeldichtung metrisch)	Carter (joint métrique simple)	Corpo (con singola guarnizio metrica)
29	See table	✻	Valve block (SAE "A" pad)	Ventilblock (SAE "A")	Bloc de distribution (plan de pose SAE A)	Blocco distributore (interfacci SAE "A")
30	526682		Coupling (SAE "A")	Kupplung (SAE "A")	Accouplement (SAE A)	Giunto (SAE "A")
	526694		Coupling (SAE "B")	Kupplung (SAE "B")	Accouplement (SAE B)	Giunto(SAE "B")
	526696		Coupling (SAE "C")	Kupplung (SAE "C")	Accouplement (SAE C)	Giunto (SAE "C")
31	See table	☐	Adapter (SAE "B"/"C" pad)	Adapter (SAE "B"/"C")	Adaptateur (plan de pose SAE B/C)	Giunto (interfaccia SAE "B"/"
32	576601		O-ring (SAE "A" pad)	O-Ring (SAE "A")	Joint torique (plan de pose SAE A)	O-ring (interfaccia SAE "A")
	401525	▲☐	O-ring (SAE "B" adapter)	O-Ring (SAE "B")	Joint torique (adaptateur SAE B)	O-ring (adattatore SAE "B")
	353264	☐	O-ring (SAE "C" adapter)	O-Ring (SAE "C")	Joint torique (adaptateur SAE C)	O-ring (adattatore SAE "C")
33	474753 (2)		Screw	Schraube	Vis	Vite
34	470866 (2)		Screw	Schraube	Vis	Vite
35	474756 (2)		Screw (SAE "A" pad)	Schraube (SAE "A")	Vis (plan de pose SAE A)	Vite (interfaccia SAE "A")
	473800 (2)	☐	Screw (SAE "B"/"C" adapter)	Schraube (SAE "B"/"C")	Vis (adaptateur SAE B/C)	Vite (adattatore SAE "B"/"C")

✻ Not available for sale

▲ Available in single shaft seal kit 02-102260 Equivalent double shaft seal kit 02-102244

● Available in rotating group kit 877420

■ Available in bearing kit 877423

☐ Available in adapter pad kit
876390 SAE B (inch)
876394 SAE B (metric)
876389 SAE C (inch)
876392 SAE C (metric)

◇ Omit on C control S/A

▦ See assembly instructions

⊞ See assembly note

✻ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102260 Erhältlich als Doppelwellen Dichtungssatz 02-102244

● Erhältlich als Rotationsbau gruppe 877420.

■ Erhältlich als Lagersatz 877423

☐ Erhältlich als Adapter satz
876390 SAE B (Zoll)
876394 SAE B (metrisch)
876389 SAE C (Zoll)
876392 SAE C (metrisch)

◇ Erhältlich bei Reglertyp C

▦ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

✻ Non disponible séparément.

▲ Compris dans la pochette 02-102260 (joint d ' arbre simple) Pochette équivalente 02-102244 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877420.

■ Compris dans le kit de roulement 877423.

☐ Compris dans le kit de plan de pose:
876390 SAE B (pouces)
876394 SAE B (métrique)
876389 SAE C (pouces)
876392 SAE C (métrique)

◇ Omis sur le sous-ensemble de commande C.

▦ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

✻ Non in vendita singolarmer

▲ Disponibile nella serie a sin guarnizione d ' albero 02-102260 Equivalente alla serie a dop guarnizione 02-102244

● Disponibile nel kit per il gruppo rotante 877420

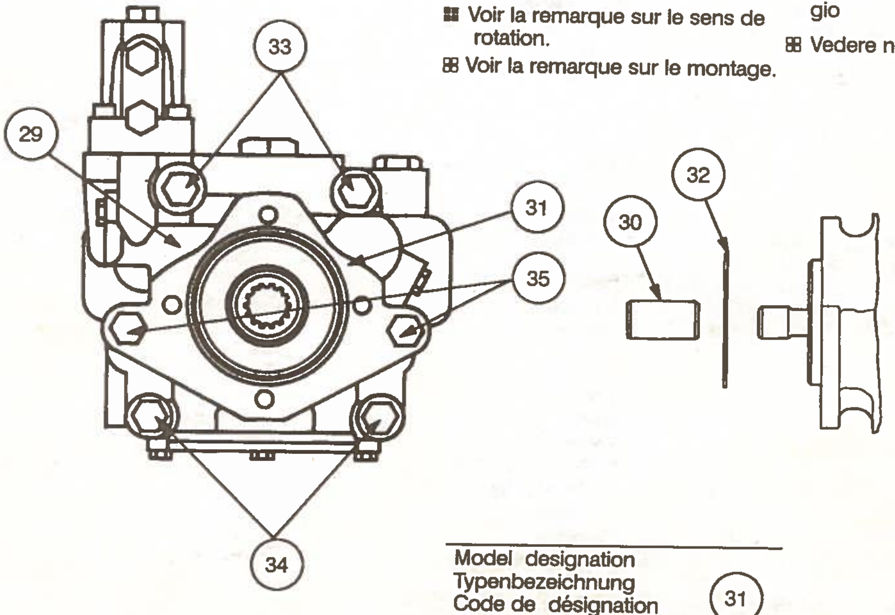
■ Disponibile nel kit del cusci netto 877423

☐ Disponibile nel kit di interfac per l'adattatore
876390 SAE B (pollici)
876394 SAE B (metrico)
876389 SAE C (pollici)
876392 SAE C (metrico)

◇ Omettere sul controllo C S/

▦ Vedere istruzioni per il mont gio

⊞ Vedere nota per il montaggi



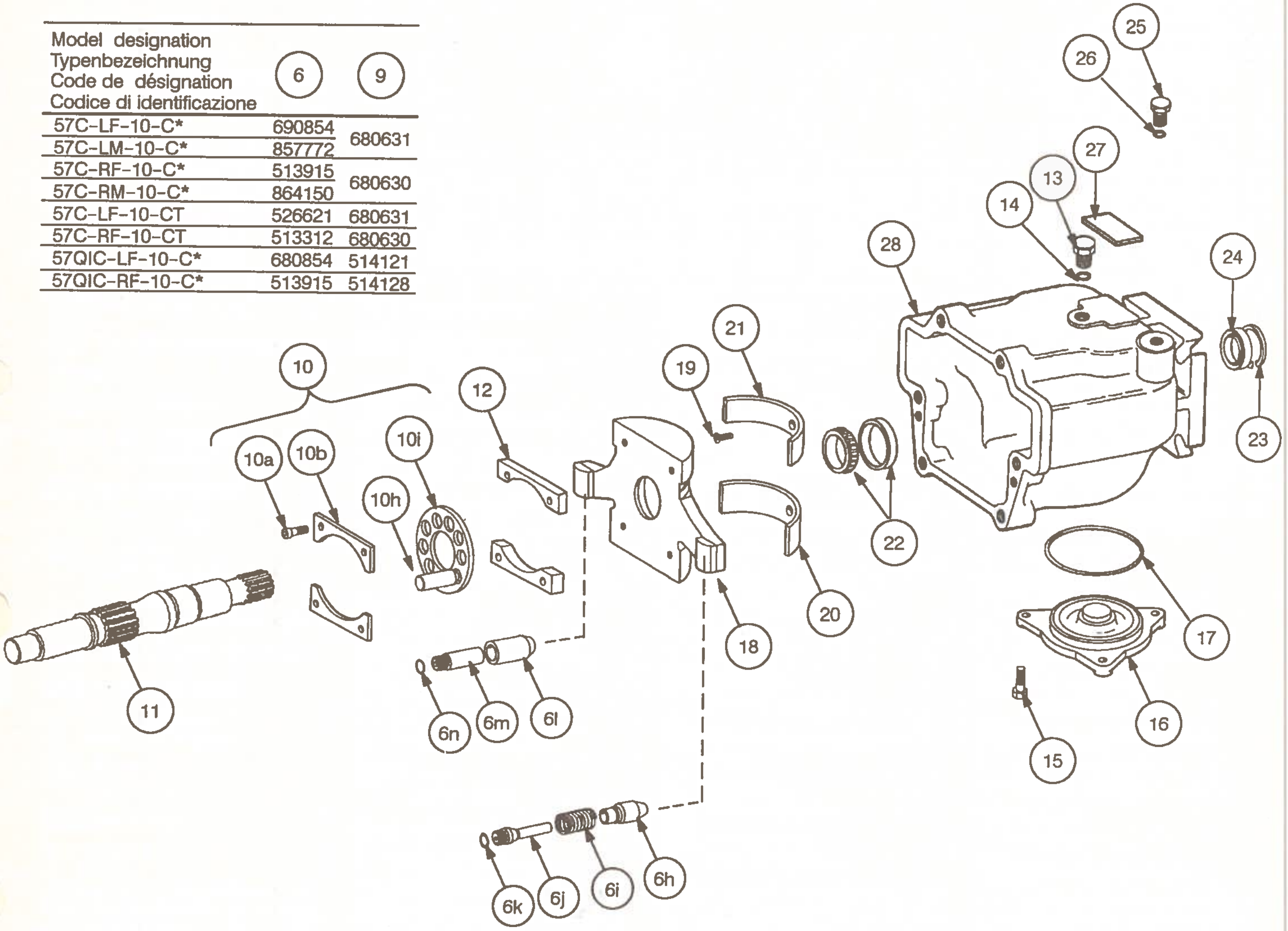
Model designation Typenbezeichnung Code de désignation Codice di identificazione	㉙
57*-LAF-10-C	526660
57*-LAM-10-C	864257
57*-RAF-10-C	526658
57*-RAM-10-C	864239
57*-LAF-10-CT	526662
57*-RAF-10-CT	526661

Model designation Typenbezeichnung Code de désignation Codice di identificazione	㉛
57*-*BF-10-C	526670
57*-*BM-10-C	876393
57C-*CF-10-C	692934
57C-*CM-10-C	876391

em os. ep. os.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
	473763 (4)		Screw	Schraube	Vis	Vite
	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
a	855564 (2)		Nut	Mutter	Ecrou	Dado
	857677		Plug	Stopfen	Bouchon	Tappo
	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
d	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
e	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
f	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
g	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
h	857676	◇	Plug	Stopfen	Bouchon	Tappo
i	154130	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
j	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
k	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
l	857679	◇	Pin	Stift	Goupille de positionnement	Spina
m	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
n	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
o	181728	◇	Plug	Stopfen	Bouchon	Tappo
p	154128	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
q	See table		Plug	Stopfen	Bouchon	Tappo
r	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
s	857672		Fressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
t	857673	◇	Load sense spool	"Load sensing"-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
u	177969 (3)	▲	O-ring	O-Ring	Joint torique	O-Ring
v	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
	474753		Screw	Schraube	Vis	Vite
	470866 (4)		Screw	Schraube	Vis	Vite
	470871		Screw	Schraube	Vis	Vite
	See table	✱	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
a	689461 (2)		Plug	Stopfen	Bouchon	Tappo
b	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
c	402643		Seat	Sitz	Siège	Sede
d	402644		Poppet	Kegel	Clapet	Otturatore
e	584455		Spring	Feder	Ressort	Molla
f	248935		Pin	Stift	Goupille de positionnement	Spina
g	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
h	526668	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
i	526665	▦	Spring	Feder	Ressort	Molla
j	526685	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
k	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
l	690211	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
m	690210	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
n	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
o	513436	■	Bearing	Lager	Roulement	Cuscinetto
7	513846		Gasket	Dichtung	Joint	Guarnizione
8	926258	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
9	See table		Valve plate	Ventilppatte	Glace de distribution	Piastra di distribuzione
10	877420	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
10a	473741 (4)	●	Screw	Schraube	Vis	Vite
10b	690218 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
10c	85560	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
10d	584524	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10e	627524	●	Spring	Feder	Ressort	Molla
10f	680624	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10g	680625	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
10h	926257	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
10i	584512	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
11	527166		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	864342		Shaft (type 1) Thru	Welle (Typ 1) durchgehend	Arbre (type 1) (traversant)	Albero (tipo 1 passante)
	513839		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	526684		Shaft (type 2) Thru	Welle (Typ 2) durchgehend	Arbre (type 2) (traversant)	Albero (tipo 2 passante)
	883083		Shaft (type N)	Welle (Typ N)	Arbre (N)	Albero (tipo N)
11a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
	472287		Key (type N)	Paßfeder (Typ N)	Clavette (type N)	Chiavetta (tipo N)
12	690801 (2)		Spacer	Distanzstück	Entretoise	Distanziale
13	513602		Plug	Stopfen	Bouchon	Tappo
14	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
15	470793 (3)		Screw	Schraube	Vis	Vite
16	526616		Cover	Deckel	Couvercle	Coperchio
17	576601	▲	O-ring	O-Ring	Joint torique	O-Ring
18	690832		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
19	690339	■	Screw	Schraube	Vis	Vite
20	513885	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
21	513886	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
22	513433	■	Bearing	Lager	Roulement	Cuscinetto
23	103824		Retaining ring	Sprengring	Circlips	Anello di arresto
24	513439		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
25	186580		Plug	Stopfen	Bouchon	Tappo
26	396098	▲	O-ring	O-Ring	Joint torique	O-Ring

Model designation Typenbezeichnung Code de désignation Codice di identificazione	2	2f	2m	2q	2r	Pressure range Druckbereich Plage de tarage Pressione di taratura
57C-**-10-C	02-125160	857681	------	627391	154128	70-250 Bar
57C-**-10-CM	02-125162	857675	------	627391	154128	35-140 Bar
57C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	6	9
57C-LF-10-C*	690854	680631
57C-LM-10-C*	857772	
57C-RF-10-C*	513915	680630
57C-RM-10-C*	864150	
57C-LF-10-CT	526621	680631
57C-RF-10-CT	513312	680630
57QIC-LF-10-C*	680854	514121
57QIC-RF-10-C*	513915	514128



⊞ NOTE

Use shims (item 8) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

⊞ HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 8 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

⊞ REMARQUE

Monter les cales d'épaisseur (rep. 8) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

⊞ NOTA

Usare spessori (particolare 8) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

■ NOTE

Right hand rotation shown. For left hand rotation install control rod (6m) & control piston (6l) in valve block port #2 & bias rod (6j), bias piston (6h), & spring (6i) in valve block port #1.

■ HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (6m) & Steuerkolben (6l) in Ventilblock Anschluß #2 und Haltestange (6j), Haltekolben (6h) & (6l) in Ventilblock Anschluß #1 motieren.

■ REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (6m) et le piston (6l) de commande dans l'orifice n° 2, et d'autre part la tige (6j) et le piston (6h) de maintien ainsi que le ressort (6i) dans l'orifice n° 1.

■ NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (6m) e il pistone di controllo (6l) nell'attacco del blocco valvola n.2; l'asta di reazione (6j), il pistone di reazione (6h) e la molla (6i) nell'attacco del blocco valvola n.1.

6 Configuration

Blank – Non thru drive
A – SAE "A" pad thru drive
B – SAE "B" pad thru drive
C – SAE "C" pad thru drive

8 Shaft

1 – SAE C Straight keyed
2 – SAE C Splined
3 – SAE CC Splined
13 – SAE CC Straight keyed

6 Bauart

Leer – Ohne durchg. Welle
A – SAE "A" Befestigung für durchg. Welle
B – SAE "B" Befestigung für durchg. Welle
C – SAE "C" Befestigung für durchg. Welle

8 Welle

1 – SAE "C" zylind. mit Paßfeder
2 – SAE "C" verzahnte Welle
3 – SAE "CC" verzahnte Welle
13 – SAE "CC" zylind. mit Paßfeder

6 Exécution

Omis – sans entraînement traversant
A – entraînement traversant avec plan de pose SAE A
B – entraînement traversant avec plan de pose SAE B
C – entraînement traversant avec plan de pose SAE C

8 Bout d'arbre

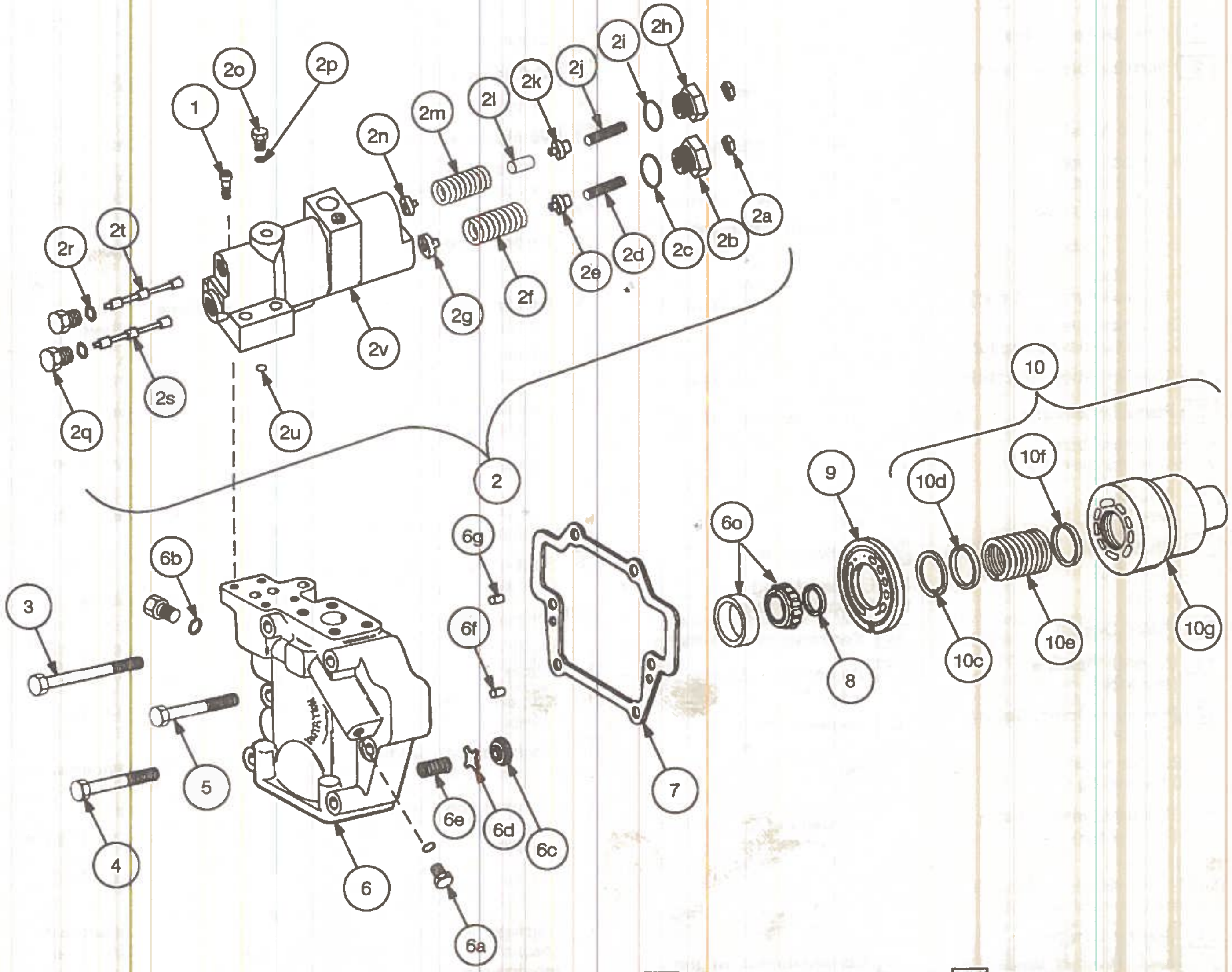
1 – cylindrique claveté SAE C
2 – cannelé SAE C
3 – cannelé SAE CC
13 – cylindrique claveté SAE CC

6 Configurazione

Vuoto – Albero non passante
A – Albero passante con flangia SAE "A"
B – Albero passante con flangia SAE "B"
C – Albero passante con flangia SAE "C"

8 Albero

1 – Cilindrico con chiavetta SAE "C"
2 – Scanalato SAE "C"
3 – Scanalato SAE "CC"
13 – Cilindrico con chiavetta SAE "CC"



11 Control Options

C – Pressure Compensator STD.
CM – Pressure Compensator
CV** – Pressure Compensator-with load sensing
CT**** – Pressure Compensator with torque limiter
CVT**** – Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C – Druckregler (Standard)
CM – Druckregler
CV** – Druckregler mit Load sensing
CT**** – Druckregler mit Drehmomentbegrenzer
CVT**** – Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C – compensateur de pression standard
CM – compensateur de pression
CV** – compensateur de pression "load-sensing"
CT**** – compensateur de pression avec limiteur de couple
CVT**** – compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C – Compensatore di pressione standard
CM – Compensatore di pressione
CV** – Compensatore di pressione con rilevatore di carico
CT**** – Compensatore di pressione con limitatore di coppia
CVT**** – compensatore di pressione con limitatore di coppia e rilevatore di carico

✻ Not available for sale

▲ Available in single shaft seal kit 02-102263
Equivalent double shaft seal kit 02-102264

● Available in rotating group kit 877422

■ Available in bearing kit 877425

◇ Omit on C control S/A

▦ See assembly instructions

⊞ See assembly note

✻ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102263
Erhältlich als Doppelwellen Dichtungssatz 02-102264

● Erhältlich als Rotationsbaugruppe 877422.

■ Erhältlich als Lagersatz 877425

◇ Erhältlich bei Reglertyp C

▦ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

✻ Non disponible séparément.

▲ Compris dans la pochette 02-102263 (joint d ' arbre simple)
Pochette équivalente 02-102264 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877422.

■ Compris dans le kit de roulement 877425.

◇ Omis sur le sous-ensemble de commande C.

▦ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

✻ Non in vendita singolarmente

▲ Disponibile nella serie a singol guarnizione d ' albero 02-102263
Equivalente alla serie a doppia guarnizione 02-102264

● Disponibile nel kit per il gruppo rotante 877422

■ Disponibile nel kit del cuscinetto 877425

◇ Omettere sul controllo C S/A

▦ Vedere istruzioni per il montaggio

⊞ Vedere nota per il montaggio

Item Pos. Rep. Pos.	Torque values Anziehmomente Couples de serrage Coppia di serraggio
1	31-37 Nm. (23-28 lb.ft.)
2a	8-10 Nm. (6-7.3 lb.ft.
2b	97-106 Nm. (71-78 lb.ft.)
2h	75-83 Nm. (55-60 lb.ft.)
2o	29-32 Nm. (21-24 lb.ft.)
2q	29-32 Nm. (21-24 lb.ft.)
3	83-102 Nm. (61-75 lb.ft.)
4	83-102 Nm. (61-75 lb.ft.)
5	83-102 Nm. (61-75 lb.ft.)
6a	12.7-13Nm. (8.9-9.5 lb.ft.)
6j	75-83 Nm. (55-60 lb.ft.)
6m	75-83 Nm. (55-60 lb.ft.)
10a	31-37 Nm. (23-27 lb.ft.)
13	97-106 Nm. (71-78 lb.ft.)
15	7-9 Nm. (5-6.6 lb.ft.)
19	3.6-4.4 Nm. (2.3-3 lb.ft.)
25	75-83 Nm. (55-60 lb.ft.)

All repairs must be made in clean conditions and by clean practices compatible with subsequent efficient operations of the unit in systems having filtration to 25µm or finer.

Bei Inbetriebnahme und Betrieb dieser Präzisionsgeräte ist die Filterung der Druckflüssigkeit – auf 25 µm oder feiner – Voraussetzung für optimale Wirtschaftlichkeit und Lebensdauer.

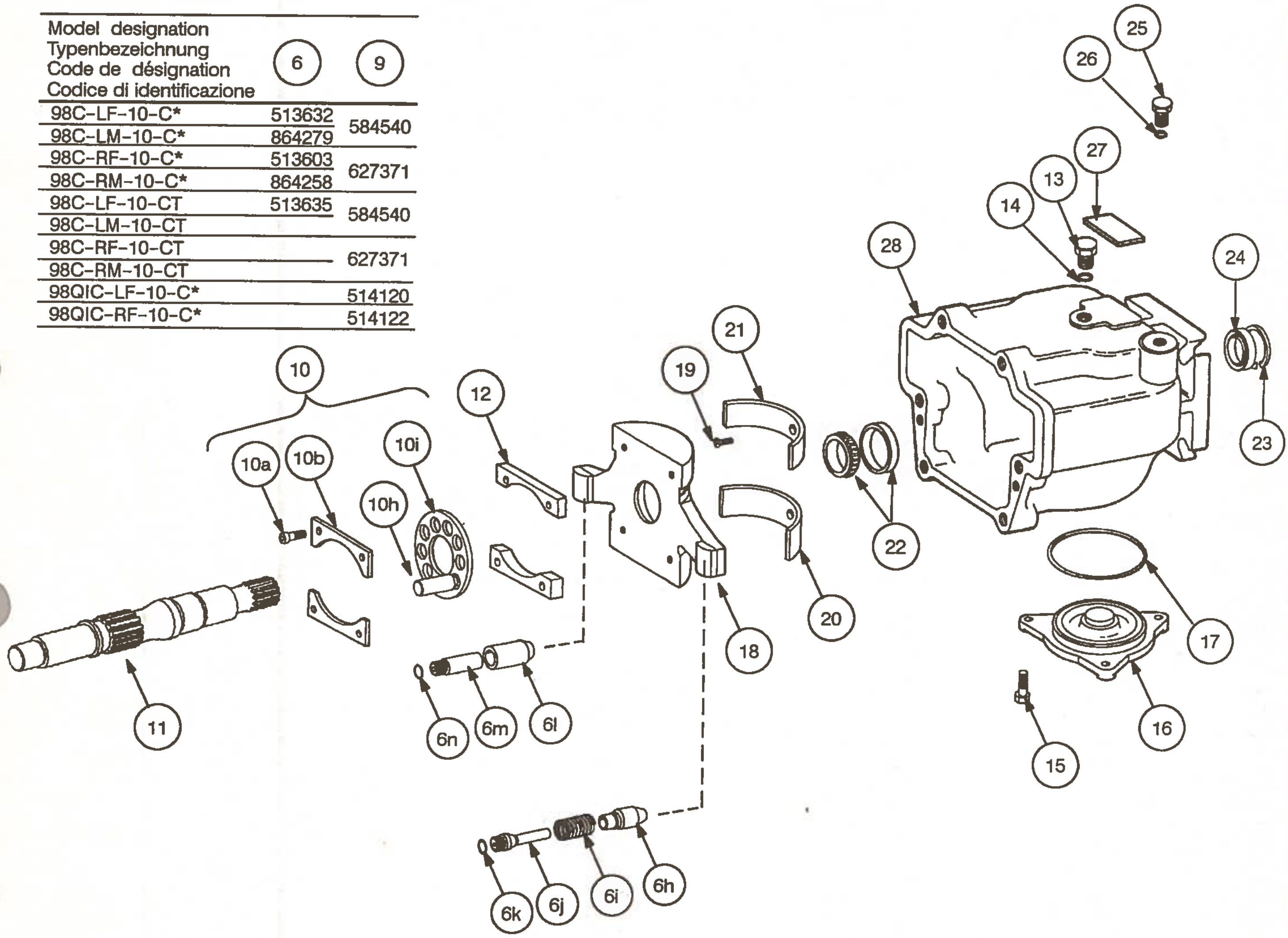
Toutes les réparations doivent être faites dans des conditions saines et par des moyens propres compatibles avec le fonctionnement correct de l'appareil dans un circuit filtré à 25 microns ou mieux.

Le riparazioni devono essere effettuate in ambiente pulito e in ogni caso in condizioni tali da consentirne un regolare funzionamento in sistemi idraulici con grado di filtrazione di 25 o più fine.

m s. p. s.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
	473763 (4)		Screw	Schraube	Vis	Vite
	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
	855564 (2)		Nut	Mutter	Ecrou	Dado
	857677		Plug	Stopfen	Bouchon	Tappo
	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
	857676	◇	Plug	Stopfen	Bouchon	Tappo
	154130	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
	857679	◇	Pin	Stift	Goupille de positionnement	Spina
	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
	181728	◇	Plug	Stopfen	Bouchon	Tappo
	154128	▲ ◇	O-ring	O-Ring	Joint torique	O-Ring
	See table		Plug	Stopfen	Bouchon	Tappo
	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
	857672		Pressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
	857673	◇	Load sense spool	"Load sensing"-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
	177969 (3)		O-ring	O-Ring	Joint torique	O-Ring
	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
	514574		Screw	Schraube	Vis	Vite
	514573 (4)		Screw	Schraube	Vis	Vite
	690406		Screw	Schraube	Vis	Vite
	See table	✱	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
a	689461 (2)		Plug	Stopfen	Bouchon	Tappo
b	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
c	402643		Seat	Sitz	Siège	Sede
d	402644		Poppet	Kegel	Clapet	Otturatore
e	584455		Spring	Feder	Ressort	Molla
f	248935		Pin	Stift	Goupille de positionnement	Spina
g	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
h	526669	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
i	526666	▦	Spring	Feder	Ressort	Molla
j	513600	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
k	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
l	526627	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
m	526628	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
n	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
o	413603	■	Bearing	Lager	Roulement	Cuscinetto
	513631		Gasket	Dichtung	Joint	Guarnizione
	941441	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
	See table		Valve plate	Ventilplatte	Glace de distribution	Piastra di distribuzione
10	877422	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
10a	473764 (4)	●	Screw	Schraube	Vis	Vite
10b	513626 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
10c	102038	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
10d	584547	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10e	627192	●	Spring	Feder	Ressort	Molla
10f	584546	●	Spring guide	Federführung	Guide de ressort	Guida della molla
10g	680627	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
10h	926246	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
10i	584539	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
11	527167		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	513627		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	864453		Shaft (type 3)	Welle (Typ 3)	Arbre (type 3)	Albero (tipo 3)
	864454		Shaft (type 13)	Welle (Typ 13)	Arbre (type 13)	Albero (tipo 13)
11a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
12	513625 (2)		Spacer	Distanzstück	Entretoise	Distanziale
13	513602		Plug	Stopfen	Bouchon	Tappo
14	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
15	470793 (3)		Screw	Schraube	Vis	Vite
16	513347		Cover	Deckel	Couvercle	Coperchio
17	355659	▲	O-ring	O-Ring	Joint torique	O-Ring
18	513629		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
19	690339 (2)	■	Screw	Schraube	Vis	Vite
20	513911	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
21	513912	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
22	388154	■	Bearing	Lager	Roulement	Cuscinetto
23	126911		Retaining ring	Sprengring	Circlips	Anello di arresto
24	589332		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
25	181792		Plug	Stopfen	Bouchon	Tappo
26	396100	▲	O-ring	O-Ring	Joint torique	O-Ring
27	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
28	513645	✱	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizione)
	864341	✱	Housing (double seal)	Gehäuse (Doppeldichtung)	Carter (joint double)	Corpo (con doppia guarnizione)

Model designation Typenbezeichnung Code de désignation Codice di identificazione	②	2f	2m	2q	2r	Pressure range Druckbereich Plage de tarage Pressione di taratura
98C-**-10-C	02-125160	857681	------	627391	154128	70-250 Bar
98C-**-10-CM	02-125162	857675	------	627391	154128	35-140 Bar
98C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	⑥	⑨
98C-LF-10-C*	513632	584540
98C-LM-10-C*	864279	
98C-RF-10-C*	513603	627371
98C-RM-10-C*	864258	
98C-LF-10-CT	513635	584540
98C-LM-10-CT		
98C-RF-10-CT		627371
98C-RM-10-CT		
98QIC-LF-10-C*		514120
98QIC-RF-10-C*		514122



⊞ NOTE

Use shims (item 8) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

⊞ HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 8 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

⊞ REMARQUE

Monter les cales d'épaisseur (rep. 8) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

⊞ NOTA

Usare spessori (particolare 8) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

∷ NOTE

Right hand rotation shown. For left hand rotation install control rod (6m) & control piston (6l) in valve block port #2 & bias rod (6j), bias piston (6h), & spring (6i) in valve block port #1.

∷ HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (6m) & Steuerkolben (6l) in Ventilblock Anschluß #2 und Haltestange (6j), Haltekolben (6h) & (6i) in Ventilblock Anschluß #1 motieren.

∷ REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (6m) et le piston (6l) de commande dans l'orifice n° 2, et d'autre part la tige (6j) et le piston (6h) de maintien ainsi que le ressort (6i) dans l'orifice n° 1.

∷ NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (6m) e il pistone di controllo (6l) nell'attacco del blocco valvola n.2; l'asta di reazione (6j), il pistone di reazione (6h) e la molla (6i) nell'attacco del blocco valvola n.1.

VICKERS
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3

Spare parts information
Ersatzteilinformation
Fiche de pièces détachées
Bollettino parti di ricambio

50

Piston pump
Kolbenpumpe
Pompe à pistons
Pompa a pistoni

PVH 74 (QI) C-R A F-1-S-10-C 25 VT 18-14

PVH	74	(QI)	C	R	A	F	1	S	10	C	25	VT	18	14
1	2	3	4	5	6	7	8	9	10	11	12	13	13	14

1 PVH Model Series

2 Variable Displacement

74- 74 cc/r

3 Quiet Version

Blank - Mobile version
QI - Quiet industrial

4 Mounting Flange

C - SAE "C" , 4 bolt
M - ISO-3019-2

5 Rotation
(Viewed from shaft end)

R - Clockwise rotation
L - Counterclockwise rotation

6 Configuration (see table)

7 Port Connections

F - SAE flange ports
M - Metric flange ports

8 Shaft
(see table)

9 Shaft Seal

S - Single
D - Double

10 Pump Design

11 Control Options
(see table)

12 Pressure Comp. Setting
(Tens of bar)

25 - 250 bar setting (C)
7 - 70 bar setting (CM)

13 Torque Limiter Setting
(Tens of bar)

18 - 180 bar
(Must be 30-80 % of Max. pressure compensator setting)

14 Control Design

30 - C/CV
13 - CT
14 - CVT

1 Baureihe PVH

2 Verstellbares Fördervolumen

74 - 74 cm^3/u

3 Leise Ausführung

Leer - Mobil-Version
QI - Leise Industrie-Version

4 Bfestigungsflansch

C - SAE "C" , 4 Schrauben
M - ISO-3019-2

5 Drehrichtung
(Mit Blick auf Wellenende)

R - Rechtslauf
L - Linkslauf

6 Bauart (siehe tabelle)

7 Systemanschlüsse

F - SAE Flansche
M - Metrische Flansche

8 Welle
(siehe tabelle)

9 Wellendichtung

S - Einzeldichtung
D - Doppeldichtung

10 Seriennummer Pumpe

11 Reglervausführung
(siehe tabelle)

12 Reglereinstellung
(in 10 bar stufen)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Einstellung Drehmomanbegrenzer
(in 10 bar Stufen)

18 - 180 bar
(Muß 30-80 % der max. Reglereinstellung betragen

14 Seriennummer Regler

30 - C/CV
13 - CT
14 - CVT

1 Série PVH

2 Cylindrée variable

74 - 74 cm^3/tr

3 Version silencieuse

Omis - version mobile
QI - version industrielle silencieuse

4 Bride de montage

C - SAE C à 4 vis
M - ISO-3019-2

5 Sens de rotation
(vu du côté arbre)

R - horaire
L - anti-horaire

6 Exécution
(Voir le tableau)

7 Raccordement des orifices

F - bride SAE
M - bride métrique

8 Bout d'arbre
(Voir le tableau)

9 Joint d'arbre

S - Simple
D - Double

10 Numéro de dessin de pompe

11 Choix de commandes
(Voir le tableau)

12 Tarage du compensateur de pression
(en dizaines de bar)

25 - 250 bar (C)
7 - 70 bar (CM)

13 Réglage du limiteur de couple
(en dizaines de bar)

18 -180 bar
(Obligatoirement 30 à 80% du tarage maxi. de compensateur)

14 Numéro de dessin de la commande

30 - C/CV
13 - CT
14 - CVT

1 Modello serie PVH

2 Cilindrata variabile

74- 74 cc/r

3 Versione silenziosa

Vuoto - versione appl.mobile
QI - Versione silenziosa appl.industriali

4 Flangia di montaggio

C - 4 fori SAE "C"
M - ISO-3019-2

5 Rotazione
(vista dal lato albero)

R - Rotazione oraria
C - Rotazione antioraria

6 Configurazione
(vedi tabella)

7 Bocche di connessione

F - attacchi flangiati SAE
M - attacchi a flangia metriche

8 Albero
(vedi tabella)

9 Guarnizione albero

S - Singola
D - Doppia

10 Serie pompa

11 Opzioni sul controllo
(vedi tabella)

12 Taratura del compensatore di pressione
(in decine di bar)

Pressione di taratura da 25 a 250 bar (C)
Pressione di taratura da 7 a 70 bar (CM)

13 Taratura del limitatore di coppia (in decine di bar)

da 18 a 180 bar
(deve essere compresa dal 30 all'80% del massimo valore tarato sul compensatore)

14 Serie

30 - C/CV
13 - CT
14 - CVT

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Released 8-1-90

6 Configuration

Blank – Non thru drive
A – SAE "A" pad thru drive
B – SAE "B" pad thru drive
C – SAE "C" pad thru drive

8 Shaft

1 – SAE C Straight keyed
2 – SAE C Splined
3 – SAE CC Splined
13 – SAE CC Straight keyed
N – ISO 3019-2 Straight keyed

6 Bauart

Leer – Ohne durchg. Welle
A – SAE "A" Befestigung für durchg. Welle
B – SAE "B" Befestigung für durchg. Welle
C – SAE "C" Befestigung für durchg. Welle

8 Welle

1 – SAE "C" zylind. mit Paßfeder
2 – SAE "C" verzahnte Welle
3 – SAE "CC" verzahnte Welle
13 – SAE "CC" zylind. mit Paßfeder
N – ISO 3019-2 zylind. mit Paßfeder

6 Exécution

Omis – sans entraînement traversant
A – entraînement traversant avec plan de pose SAE A
B – entraînement traversant avec plan de pose SAE B
C – entraînement traversant avec plan de pose SAE C

8 Bout d'arbre

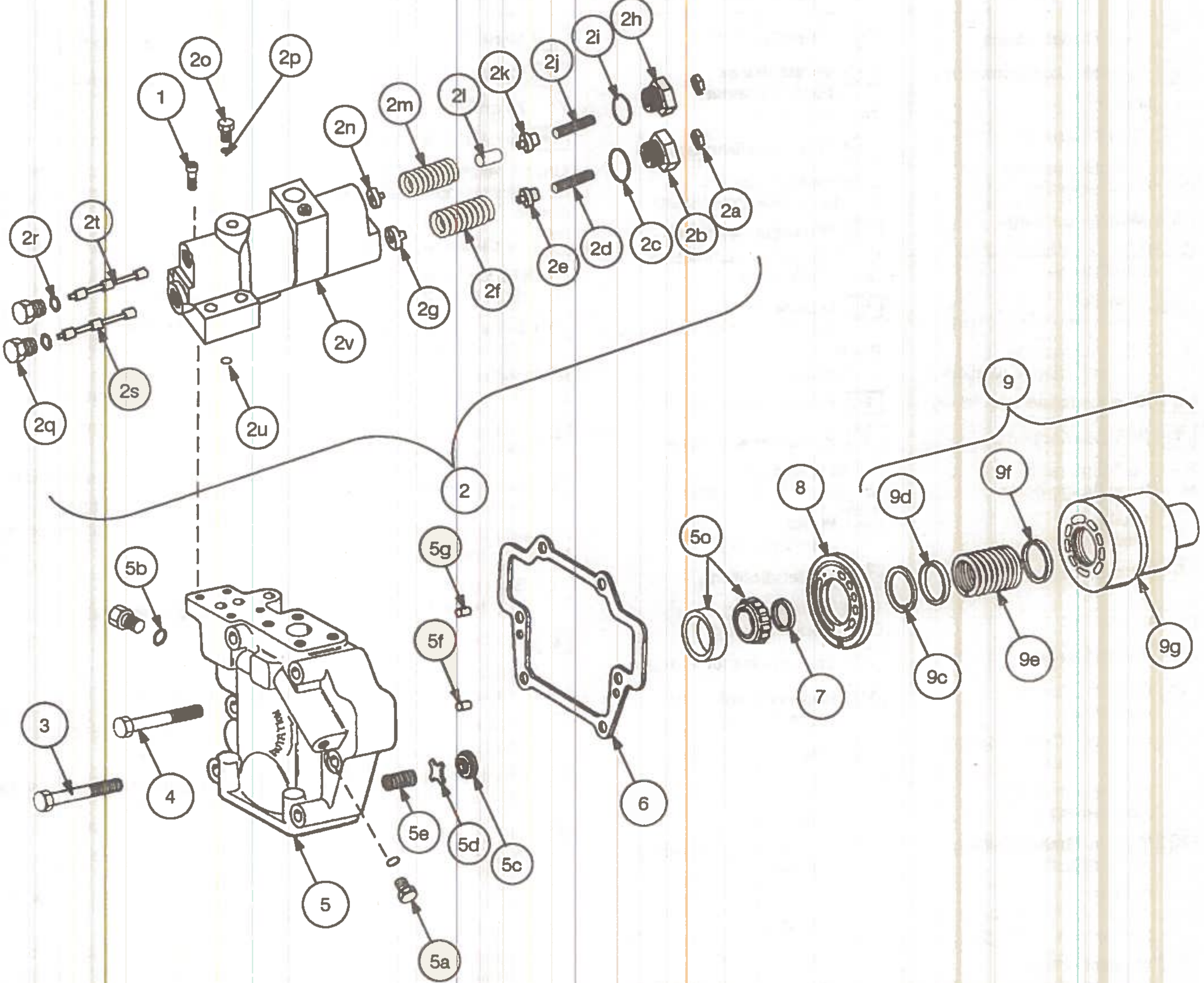
1 – cylindrique claveté SAE C
2 – cannelé SAE C
3 – cannelé SAE CC
13 – cylindrique claveté SAE CC
N – ISO 3019-2 cylindrique claveté

6 Configurazione

Vuoto – Albero non passante
A – Albero passante con flangia SAE "A"
B – Albero passante con flangia SAE "B"
C – Albero passante con flangia SAE "C"

8 Albero

1 – Cilindrico con chiavetta SAE "C"
2 – Scanalato SAE "C"
3 – Scanalato SAE "CC"
13 – Cilindrico con chiavetta SAE "CC"
N – Cilindrico con chiavetta ISO 3019-2



11 Control Options

C – Pressure Compensator STD.
CM – Pressure Compensator
CV** – Pressure Compensator-with load sensing
CT**** – Pressure Compensator with torque limiter
CVT**** – Pressure Compensator with torque limiter & load-sense

11 Reglervausführung

C – Druckregler (Standard)
CM – Druckregler
CV** – Druckregler mit Load sensing
CT**** – Druckregler mit Drehmomentbegrenzer
CVT**** – Druckregler mit Drehmomentbegrenzer und Load sensing

11 Choix de commandes

C – compensateur de pression standard
CM – compensateur de pression
CV** – compensateur de pression "load-sensing"
CT**** – compensateur de pression avec limiteur de couple
CVT**** – compensateur de pression "load-sensing" avec limiteur de couple

11 Opzioni sul controllo

C – Compensatore di pressione standard
CM – Compensatore di pressione
CV** – Compensatore di pressione con rilevatore di carico
CT**** – Compensatore di pressione con limitatore di coppia
CVT**** – compensatore di pressione con limitatore di coppia e rilevatore di carico

✱ Not available for sale

▲ Available in single shaft seal kit 02-102261
Equivalent double shaft seal kit 02-102262

● Available in rotating group kit 877421

■ Available in bearing kit 877424

◇ Omit on C control S/A

▦ See assembly instructions

⊞ See assembly note

✱ Nicht lieferbar

▲ Erhältlich als Einzelwellen Dichtungssatz 02-102261
Erhältlich als Doppelwellen Dichtungssatz 02-102262

● Erhältlich als Rotationsbau gruppe 877421.

■ Erhältlich als Lagersatz 877424

◇ Erhältlich bei Reglertyp C

▦ Siehe Montageanweisungen

⊞ Siehe Mantagchinweis

✱ Non disponible séparément.

▲ Compris dans la pochette 02-102261 (joint d ' arbre simple)
Pochette équivalente 02-102262 (joint d ' arbre double)

● Compris dans le kit d'ensemble rotatif 877421.

■ Compris dans le kit de roulement 877424.

◇ Omis sur le sous-ensemble de commande C.

▦ Voir la remarque sur le sens de rotation.

⊞ Voir la remarque sur le montage.

✱ Non in vendita singolarmente

▲ Disponibile nella serie a singol guarnizione d ' albero 02-102261
Equivalente alla serie a doppia guarnizione 02-102262

● Disponibile nel kit per il gruppo rotante 877421

■ Disponibile nel kit del cuscinetto 877424

◇ Omettere sul controllo C S/A

▦ Vedere istruzioni per il montaggio

⊞ Vedere nota per il montaggio

Item Pos. Rep. Pos.	Torque values Anziehmomente Couples de serrage Coppia di serraggio
1	31-37 Nm. (23-28 lb.ft.)
2a	8-10 Nm. (6-7.3 lb.ft.
2b	97-106 Nm. (71-78 lb.ft.)
2h	75-83 Nm. (55-60 lb.ft.)
2o	29-32 Nm. (21-24 lb.ft.)
2q	29-32 Nm. (21-24 lb.ft.)
3	85-103 Nm. (63-76 lb.ft.)
4	85-103 Nm. (63-76 lb.ft.)
5a	12.7-13Nm. (8.9-9.5 lb.ft.)
5j	75-83 Nm. (55-60 lb.ft.)
5m	75-83 Nm. (55-60 lb.ft.)
9a	13-15 Nm. (9-11 lb.ft.)
12	97-106 Nm. (71-78 lb.ft.)
14	7-9 Nm. (5-6.6 lb.ft.)
18	3.6-4.4 Nm. (2.3-3 lb.ft.)
24	54-59 Nm. (40-43 lb.ft.)

All repairs must be made in clean conditions and by clean practices compatible with subsequent efficient operations of the unit in systems having filtration to 25µm or finer.

Bei Inbetriebnahme und Betrieb dieser Präzisionsgeräte ist die Filterung der Druckflüssigkeit - auf 25 µm oder feiner - Voraussetzung für optimale Wirtschaftlichkeit und Lebensdauer.

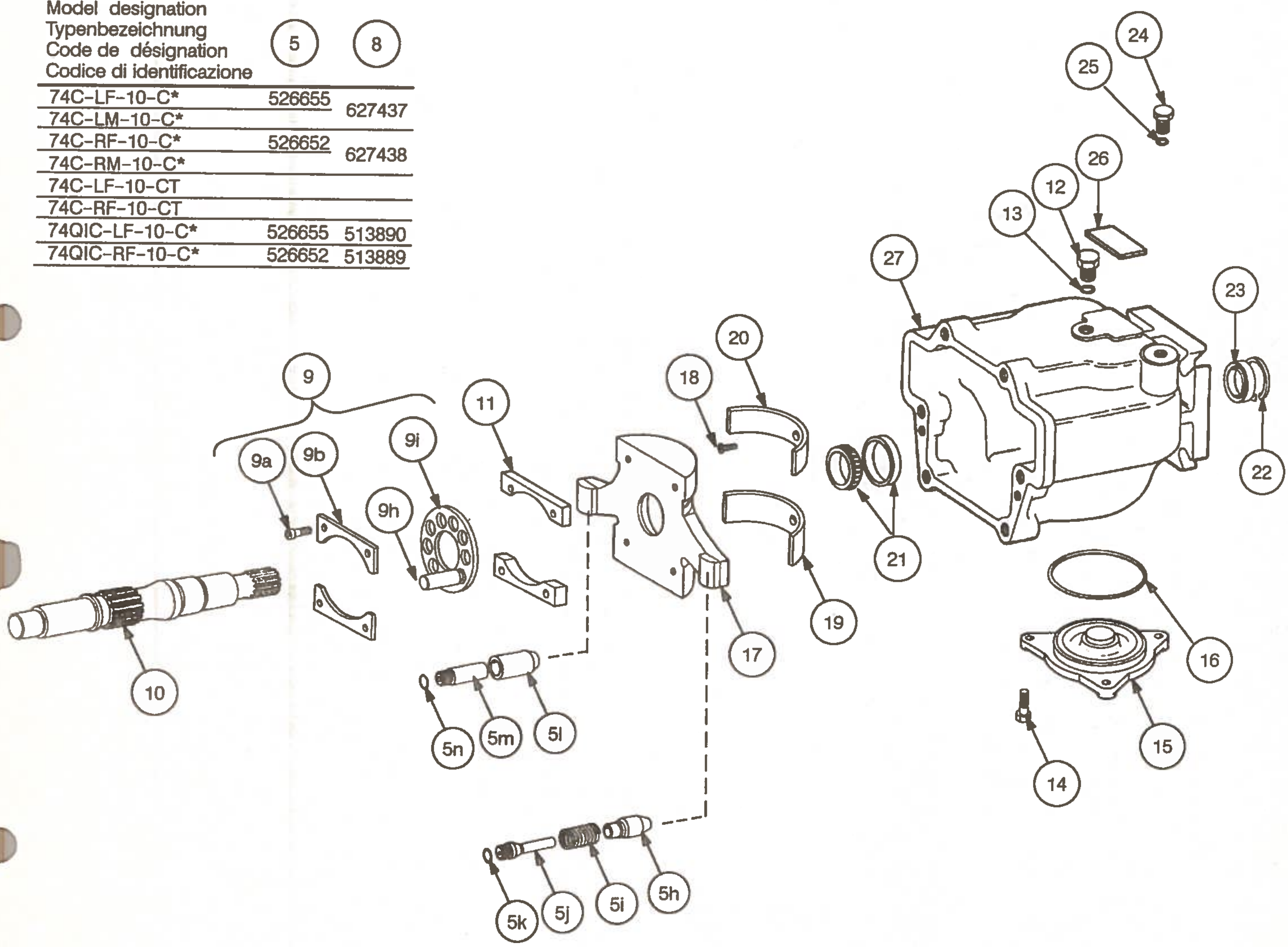
Toutes les réparations doivent être faites dans des conditions saines et par des moyens propres compatibles avec le fonctionnement correct de l'appareil dans un circuit filtré à 25 microns ou mieux.

Le riparazioni devono essere effettuate in ambiente pulito e in ogni caso in condizioni tali da consentirne un regolare funzionamento in sistemi idraulici con grado di filtrazione di 25 o più fine.

m s. p. s.	Part no. Teile-Nr. N°de pièce No.pezzo		Description	Bezeichnung	Désignation	Descrizione
	473763 (4)		Screw	Schraube	Vis	Vite
	See table		Control S/A kit	Baugruppe Regler	Kit de sous-ensemble de commande	Kit controllo S/A
	855564 (2)		Nut	Mutter	Ecrou	Dado
	857677		Plug	Stopfen	Bouchon	Tappo
	154131	▲	O-ring	O-Ring	Joint torique	O-Ring
	857678		Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
	See table		Control spring	Reglerfeder	Ressort de commande	Molla di regolazione
	857734		Spring guide	Federführung	Guide de ressort	Guida della molla
	857676	◇	Plug	Stopfen	Bouchon	Tappo
	154130	▲◇	O-ring	O-Ring	Joint torique	O-Ring
	857678	◇	Adjustment screw	Einstellschraube	Vis de réglage	Vite di regolazione
	857674	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
	857679	◇	Pin	Stift	Goupille de positionnement	Spina
ı	See table	◇	Load spring	Steuerfeder	Ressort de charge	Molla di carico
	857764	◇	Spring guide	Federführung	Guide de ressort	Guida della molla
	181728	◇	Plug	Stopfen	Bouchon	Tappo
	154128	▲	O-ring	O-Ring	Joint torique	O-Ring
	See table	◇	Plug	Stopfen	Bouchon	Tappo
	See table	▲	O-ring	O-Ring	Joint torique	O-Ring
	857672		Pressure limiter spool	Druckbegrenzer-Kolben	Tiroir de limiteur de pression	Cursore limitatore di pressione
	857673	◇	Load sense spool	"Load sensing"-Kolben	Tiroir de détection de charge	Cursore di rilevazione carico
	177969 (3)		O-ring	O-Ring	Joint torique	O-Ring
	857722		Body (C/CM)	Körper (C/CM)	Corps (C/CM)	Corpo (C/CM)
	857733		Body (CV)	Körper (CV)	Corps (CV)	Corpo (CV)
	473483 (4)		Screw	Schraube	Vis	Vite
	473478 (2)		Screw	Schraube	Vis	Vite
	See table	✱	Valve block	Ventilblock	Bloc de distribution	Blocco valvola
	689461 (2)		Plug	Stopfen	Bouchon	Tappo
	154125 (2)	▲	O-ring	O-Ring	Joint torique	O-Ring
	402643		Seat	Sitz	Siège	Sede
	402644		Poppet	Kegel	Clapet	Otturatore
	584455		Spring	Feder	Ressort	Molla
	248935		Pin	Stift	Goupille de positionnement	Spina
	471512 (2)		Pin	Stift	Goupille de positionnement	Spina
	690816	▦	Bias piston	Haltekolben	Piston de maintien	Pistone di reazione
	526667	▦	Spring	Feder	Ressort	Molla
	690806	▦	Bias rod	Haltestange	Tige de maintien	Asta di reazione
	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
	690804	▦	Control Piston	Reglerkolben	Piston de commande	Pistone di controllo
ı	690805	▦	Control rod	Reglerstange	Tige de commande	Asta di controllo
	200104	▲	O-ring	O-Ring	Joint torique	O-Ring
	388153	■	Bearing	Lager	Roulement	Cuscinetto
	526631	▲	Gasket	Dichtung	Joint	Guarnizione
	941441	⊞	Shaft spacer kit	Scheibensatz	Kit de cales d'épaisseur pour arbre	Insieme distanziale albero
	See table		Valve plate	Ventilpatte	Glace de distribution	Piastra di distribuzione
	877421	●	Rotating group kit	Rotationsbaugruppe	Ensemble rotatif	Kit gruppo rotante
	473741 (4)	●	Screw	Schraube	Vis	Vite
	690218 (2)	●	Limiter	Distanzstück	Limiteur	Limitatore
	91365	●	Retaining ring	Sprengring	Bague de maintien	Anello di arresto
	631568	●	Spring guide	Federführung	Guide de ressort	Guida della molla
	584454	●	Spring	Feder	Ressort	Molla
	584483	●	Spring guide	Federführung	Guide de ressort	Guida della molla
	680626	●	Cylinder block	Zylinderblock	Barillet	Blocco cilindri
	941424	●	Piston kit	Kolbensatz	Jeu de pistons	Kit pistone
	584474	●	Shoe cage	Schhkäfig	Plaque de poussée	Piastra portapattino
	692567		Shaft (type 1)	Welle (Typ 1)	Arbre (type 1)	Albero (tipo 1)
	513864		Shaft (type 2)	Welle (Typ 2)	Arbre (type 2)	Albero (tipo 2)
	864343		Shaft (type 3)	Welle (Typ 3)	Arbre (type 3)	Albero (tipo 3)
	864344		Shaft (type 13)	Welle (Typ 13)	Arbre (type 13)	Albero (tipo 13)
	883082		Shaft (type N)	Welle (Typ N)	Arbre (N)	Albero (tipo N)
a	114516		Key (type 1)	Paßfeder (Typ 1)	Clavette (type 1)	Chiavetta (tipo 1)
	472287		Key (type N)	Paßfeder (Typ N)	Clavette (type N)	Chiavetta (tipo N)
	526639 (2)		Spacer	Distanzstück	Entretoise	Distanziale
	513602		Plug	Stopfen	Bouchon	Tappo
	396102	▲	O-ring	O-Ring	Joint torique	O-Ring
	470793 (3)		Screw	Schraube	Vis	Vite
	526637		Cover	Deckel	Couvercle	Coperchio
	411575	▲	O-ring	O-Ring	Joint torique	O-Ring
	526651		Yoke S/A	Baugruppe Schrägscheibe	Sous-ensemble d'étrier	Piastra oscillante S/A
	690339	■	Screw	Schraube	Vis	Vite
	513927	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
	513926	■	Saddle bearing	Sattellager	Demi-coquille	Semisede del cuscinetto
	589093	■	Bearing	Lager	Roulement	Cuscinetto
	126911		Retaining ring	Sprengring	Circlips	Anello di arresto
	589332		Shaft seal	Wellendrichtring	Joint d'arbre	Guarnizione dell'albero
	186580		Plug	Stopfen	Bouchon	Tappo
	396098	▲	O-ring	O-Ring	Joint torique	O-Ring
	594329		Nameplate	Typenschild	Plaque signalétique	Piastrina
	526649	✱	Housing (single seal)	Gehäuse (Einzeldichtung)	Carter (joint simple)	Corpo (con singola guarnizione)
	883085	✱	Housing (metric single seal)	Gehäuse (Einzeldichtung metrisch)	Carter (joint métrique simple)	Corpo (con singola guarnizione metrica)

Model designation Typenbezeichnung Code de désignation Codice di identificazione	2	2f	2m	2q	2r	Pressure range Druckbereich Plage de tarage Pressione di taratura
74C-**-10-C	02-125160	857681	-------	627391	154128	70-250 Bar
74C-**-10-CM	02-125162	857675	-------	627391	154128	35-140 Bar
74C-**-10-CV	02-125161	857681	857688	627391 (2)	154128 (2)	70-280 Bar

Model designation Typenbezeichnung Code de désignation Codice di identificazione	5	8
74C-LF-10-C*	526655	627437
74C-LM-10-C*		
74C-RF-10-C*	526652	627438
74C-RM-10-C*		
74C-LF-10-CT		
74C-RF-10-CT		
74QIC-LF-10-C*	526655	513890
74QIC-RF-10-C*	526652	513889



⊞ NOTE

Use shims (item 7) as required to obtain 0.01-0.10 mm (.0004-.004 in.) axial shaft endplay.

■ NOTE

Right hand rotation shown. For left hand rotation install control rod (5m) & control piston (5l) in valve block port #2 & bias rod (5j), bias piston (5h), & spring (5i) in valve block port #1.

⊞ HINWEIS

Erforliche Anzahl Scheiben Pos. Nr. 7 für ein axiales Wellenspiel von 0.01-0.10 mm (.0004-.004 in) verwenden.

■ HINWEIS

Dargestellt für Rechtslauf. Für Linkslauf Steuerstange (5m) & Steuerkolben (5l) in Ventilblock Anschluß #2 und Haltestange (5j), Haltekolben (5h) & (5l) in Ventilblock Anschluß #1 motieren.

⊞ REMARQUE

Monter les cales d'épaisseur (rep. 7) nécessaires pour que l'arbre ait un jeu axial de 0,01 à 0,10 mm (0,0004-0,004 in).

■ REMARQUE

Rotation à droite: modèle illustré. Rotation à gauche: dans le bloc de distribution, monter d'une part la tige (5m) et le piston (5l) de commande dans l'orifice n° 2, et d'autre part la tige (5j) et le piston (5h) de maintien ainsi que le ressort (5i) dans l'orifice n° 1.

⊞ NOTA

Usare spessori (particolare 7) necessari per realizzare un gioco assiale all'estremita' dell'albero di 0.01-0.10 mm.

■ NOTA

Viene illustrata la rotazione destra. Per la rotazione a sinistra installare l'asta di controllo (5m) e il pistone di controllo (5l) nell'attacco del blocco valvola n.2; l'asta di reazione (5j), il pistone di reazione (5h) e la molla (5i) nell'attacco del blocco valvola n.1.

VICKERS

A TRINOVA Company

Vickers Incorporated
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P. O. Box 302
Troy, Michigan 48007-0302
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VICKERS®

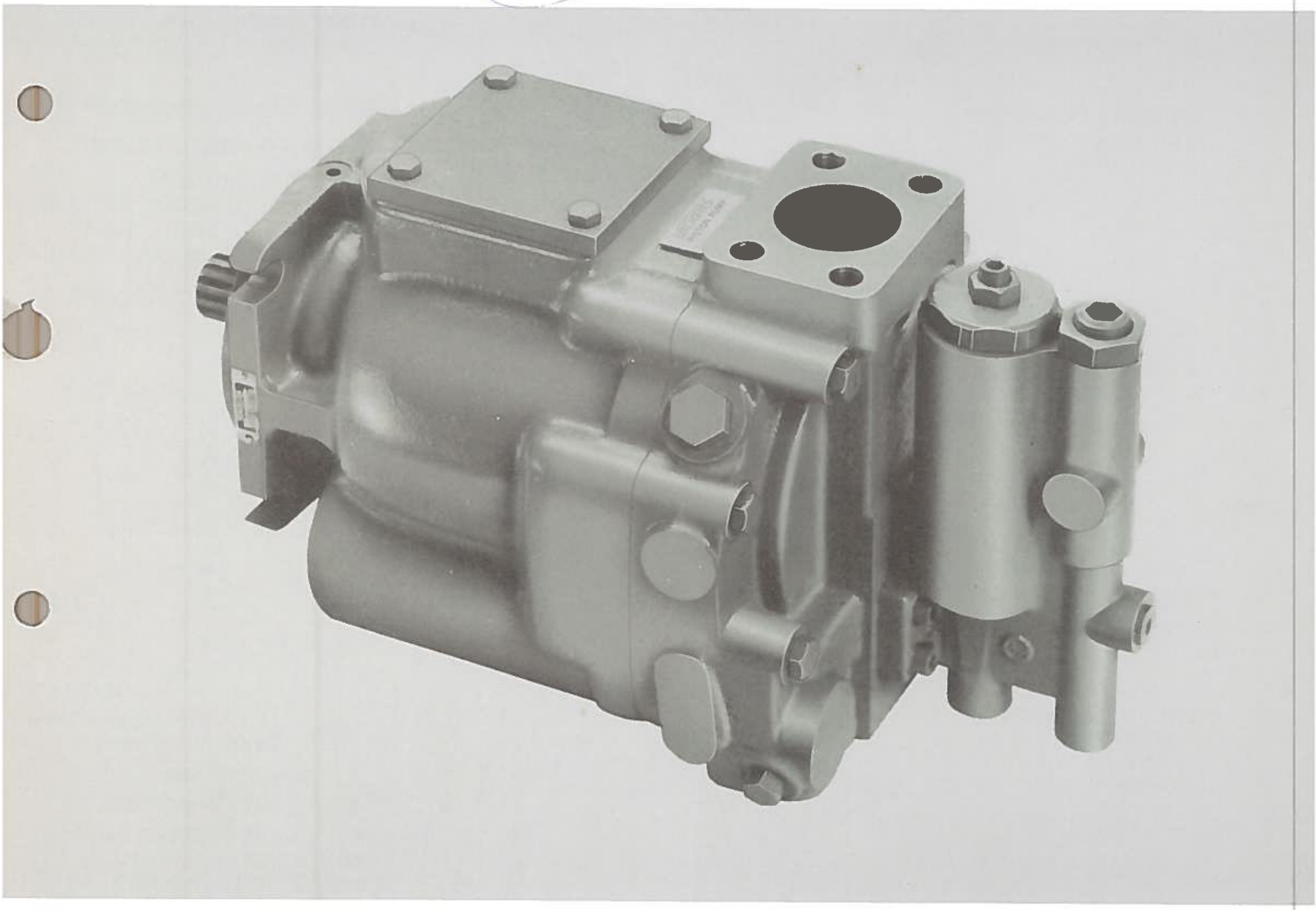
A TRINOVA COMPANY

Service Parts Information

**HEAVY DUTY
PISTON PUMP
STANDARD/
THRU DRIVE**

PVE35QI*-**-(M)(D)-22-C(*)V-21

5P



Vickers, Incorporated

1401 Crooks Road
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Released 8-1-88 **M-2236-S**

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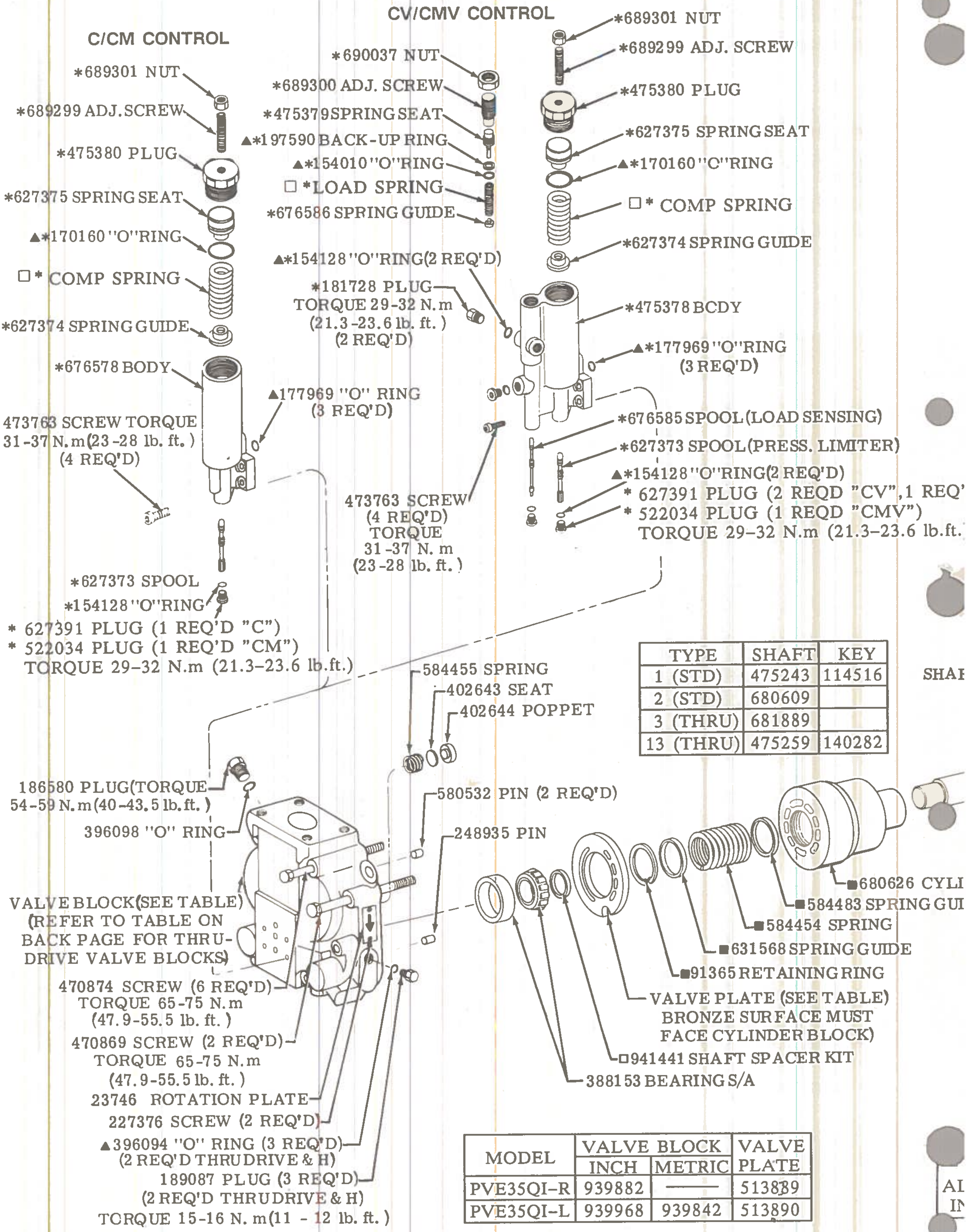
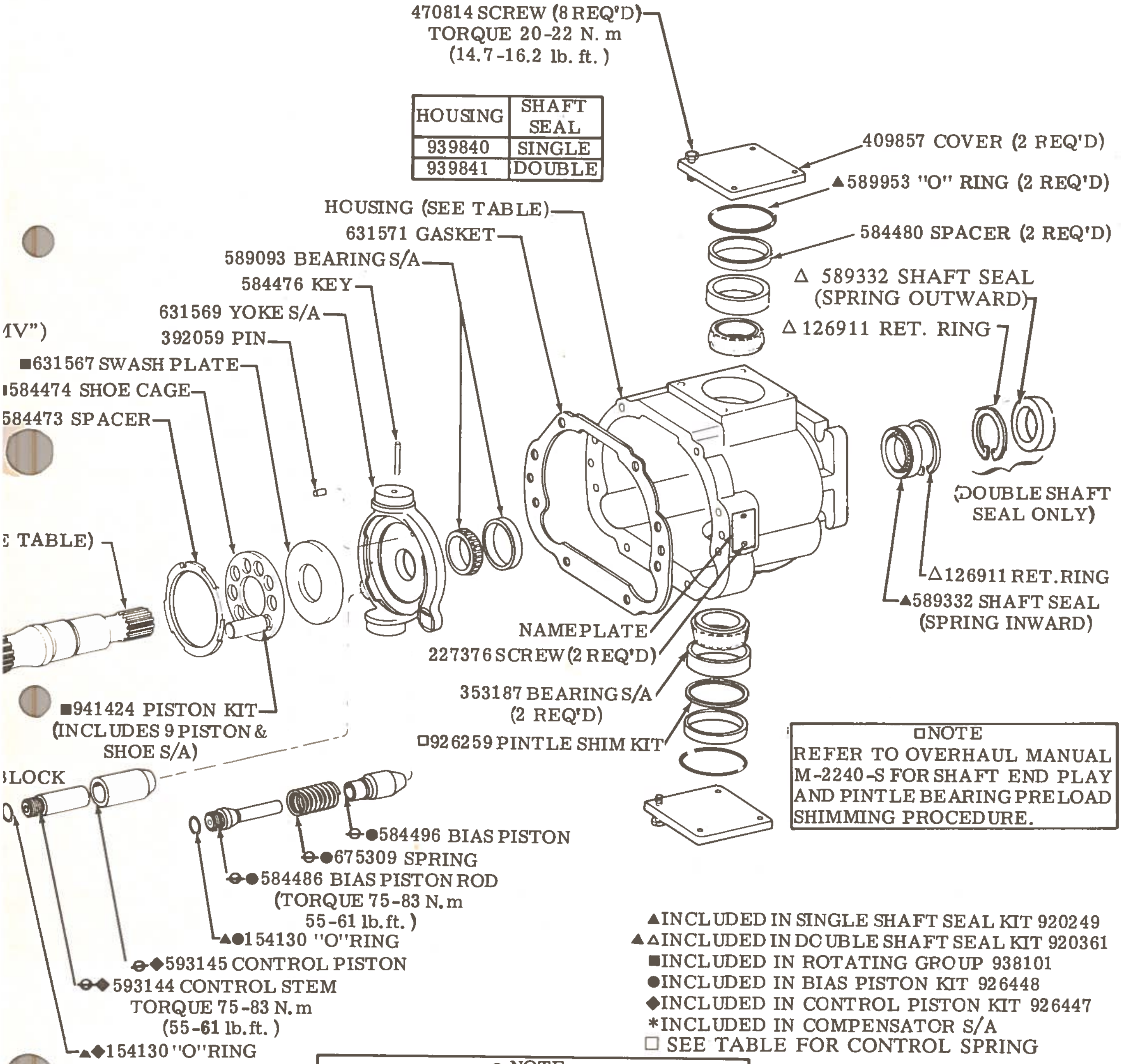


C/CM CONTROL
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O" RING
☐* COMP SPRING
*627374 SPRING GUIDE
*676578 BODY
473763 SCREW TORQUE 31-37 N.m (23-28 lb. ft.) (4 REQ'D)
▲177969 "O" RING (3 REQ'D)
*627373 SPOOL
*154128 "O" RING
* 627391 PLUG (1 REQ'D "C")
* 522034 PLUG (1 REQ'D "CM")
TORQUE 29-32 N.m (21.3-23.6 lb.ft.)
CV/CMV CONTROL
*690037 NUT
*689300 ADJ. SCREW
*475379 SPRING SEAT
▲*197590 BACK-UP RING
▲*154010 "O" RING
☐ *LOAD SPRING
*676586 SPRING GUIDE
▲*154128 "O" RING (2 REQ'D)
*181728 PLUG TORQUE 29-32 N.m (21.3-23.6 lb. ft.) (2 REQ'D)
473763 SCREW (4 REQ'D) TORQUE 31-37 N. m (23-28 lb. ft.)
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O" RING
☐* COMP SPRING
*627374 SPRING GUIDE
*475378 BODY
▲*177969 "O" RING (3 REQ'D)
*676585 SPOOL (LOAD SENSING)
*627373 SPOOL (PRESS. LIMITER)
▲*154128 "O" RING (2 REQ'D)
* 627391 PLUG (2 REQD "CV", 1 REQ'
* 522034 PLUG (1 REQD "CMV")
TORQUE 29-32 N.m (21.3-23.6 lb.ft.
584455 SPRING
402643 SEAT
402644 POPPET
186580 PLUG (TORQUE 54-59 N.m (40-43.5 lb.ft.)
396098 "O" RING
580532 PIN (2 REQ'D)
248935 PIN
VALVE BLOCK (SEE TABLE) (REFER TO TABLE ON BACK PAGE FOR THRU-DRIVE VALVE BLOCKS)
470874 SCREW (6 REQ'D) TORQUE 65-75 N.m (47.9-55.5 lb. ft.)
470869 SCREW (2 REQ'D) TORQUE 65-75 N.m (47.9-55.5 lb. ft.)
23746 ROTATION PLATE
227376 SCREW (2 REQ'D)
▲396094 "O" RING (3 REQ'D) (2 REQ'D THRUDRIVE & H)
189087 PLUG (3 REQ'D) (2 REQ'D THRUDRIVE & H) TORQUE 15-16 N. m (11 - 12 lb. ft.)
■680626 CYLI
■584483 SPRING GUI
■584454 SPRING
■631568 SPRING GUIDE
■91365 RETAINING RING
VALVE PLATE (SEE TABLE) BRONZE SURFACE MUST FACE CYLINDER BLOCK)
☐941441 SHAFT SPACER KIT
388153 BEARING S/A
SHAF
AL
IN

TYPE	SHAFT	KEY
1 (STD)	475243	114516
2 (STD)	680609	
3 (THRU)	681889	
13 (THRU)	475259	140282

MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE35QI-R	939882	———	513889
PVE35QI-L	939968	939842	513890

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)



HOUSING	SHAFT SEAL
939840	SINGLE
939841	DOUBLE

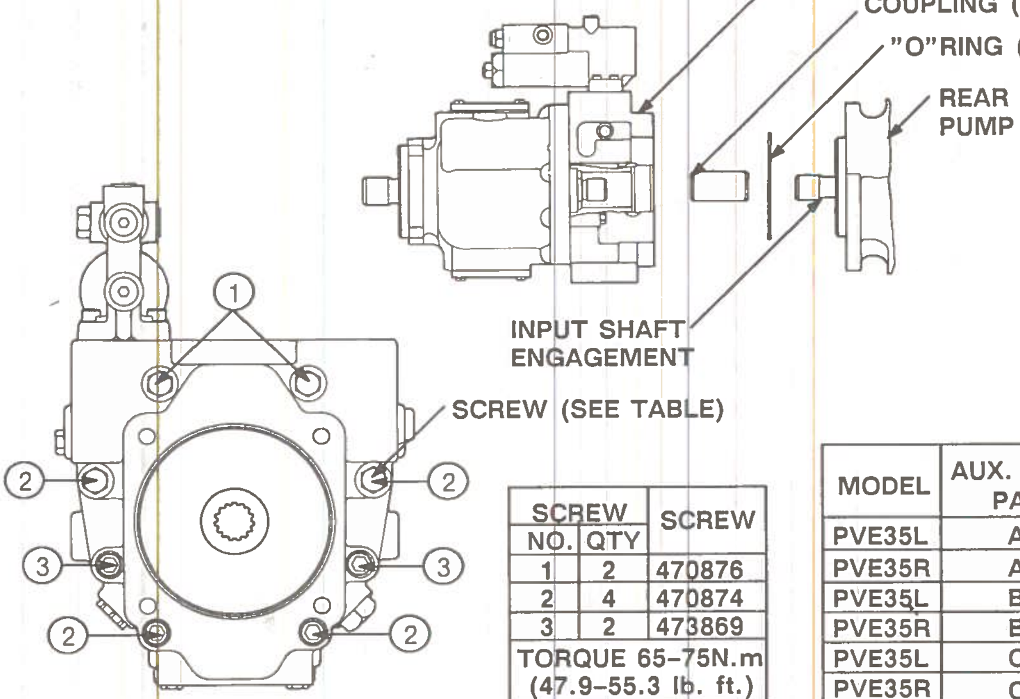
☐NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

▲INCLUDED IN SINGLE SHAFT SEAL KIT 920249
▲ΔINCLUDED IN DOUBLE SHAFT SEAL KIT 920361
■INCLUDED IN ROTATING GROUP 938101
●INCLUDED IN BIAS PISTON KIT 926448
◆INCLUDED IN CONTROL PISTON KIT 926447
*INCLUDED IN COMPENSATOR S/A
☐ SEE TABLE FOR CONTROL SPRING

▲ NOTE
LS MARKED ▲ INCLUDED
LE SHAFT SEAL KIT.

⊖ NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.

THRU-DRIVE MODELS



INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	989141
SAE-B	989153
SAE-BB	989167
SAE-C	989154
SAE-CC	685537

SCREW NO.	SCREW QTY	SCREW
1	2	470876
2	4	470874
3	2	473869
TORQUE 65-75N.m (47.9-55.3 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK INCH	VALVE BLOCK METRIC	"O"RING
PVE35L	A	939843	939966	576601
PVE35R	A	939886	———	
PVE35L	B	939881	———	401525
PVE35R	B	939844	939967	
PVE35L	C	939883	———	353264
PVE35R	C	500793	500679	

MODEL CODE BREAKDOWN

P V E 35(QI) * - * * (M) (D) - 22 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

35 - 35 GPM @ 1800 RPM (4.5 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
A - SIDE PORT 'A' PAD AUX. MOUNT, SIDE MOUNT CONTROL
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

1 - STRAIGHT KEYED
2 - SPLINED
3 - SPLINED
13 - STRAIGHT KEYED

9 PORT DESIGNATION

(4 BOLT FLANGE)
BLANK - SAE I-518
M - ISO/DIS 6162

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

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Service Parts Information

**HEAVY DUTY
PISTON PUMP
STANDARD/
THRU DRIVE**

PVE62QI*-**-(M)(D)-21-C(*)V-21

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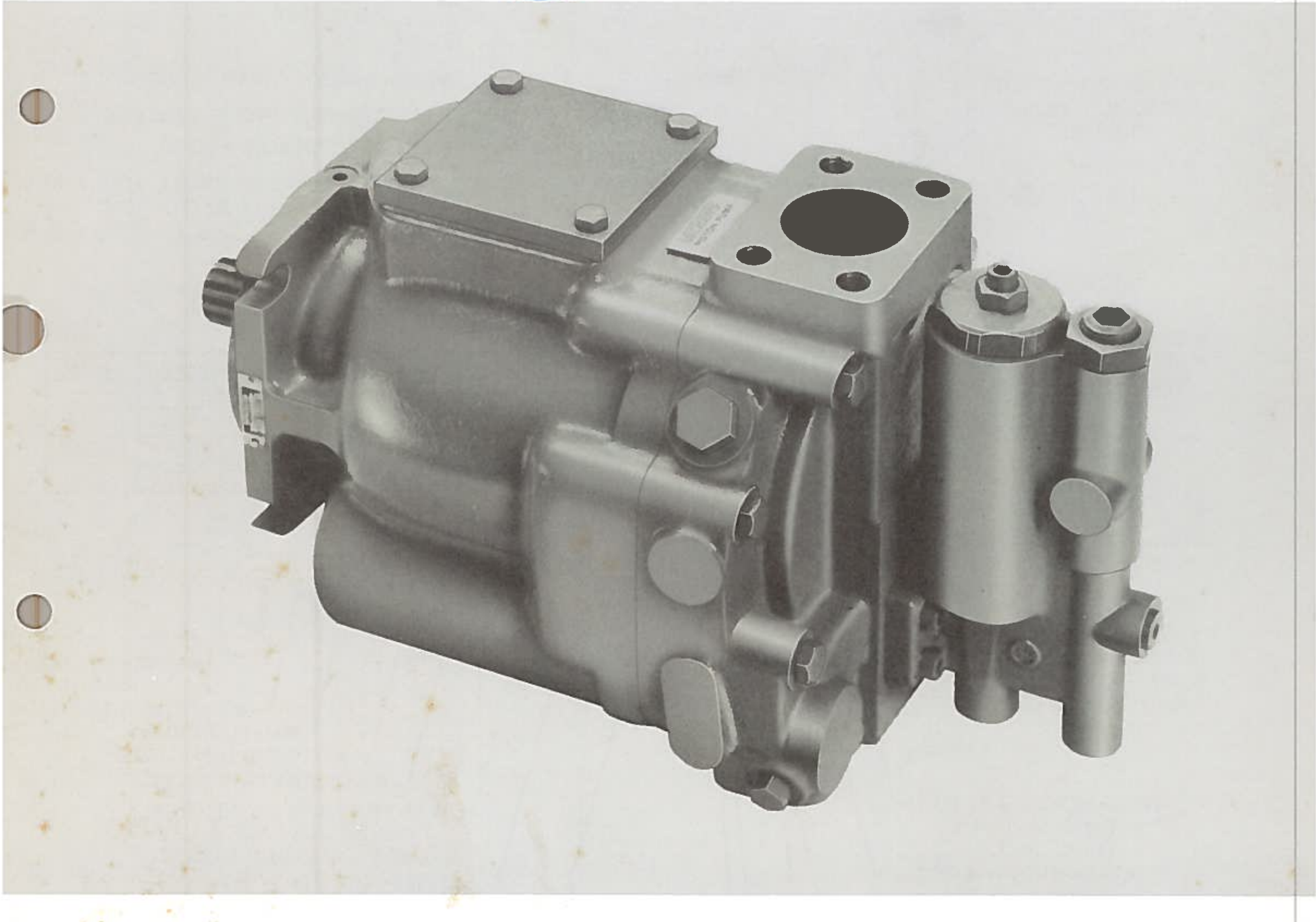

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1401 Crooks Road
Troy, Michigan 48084

Released 8-1-88 M-2238-S

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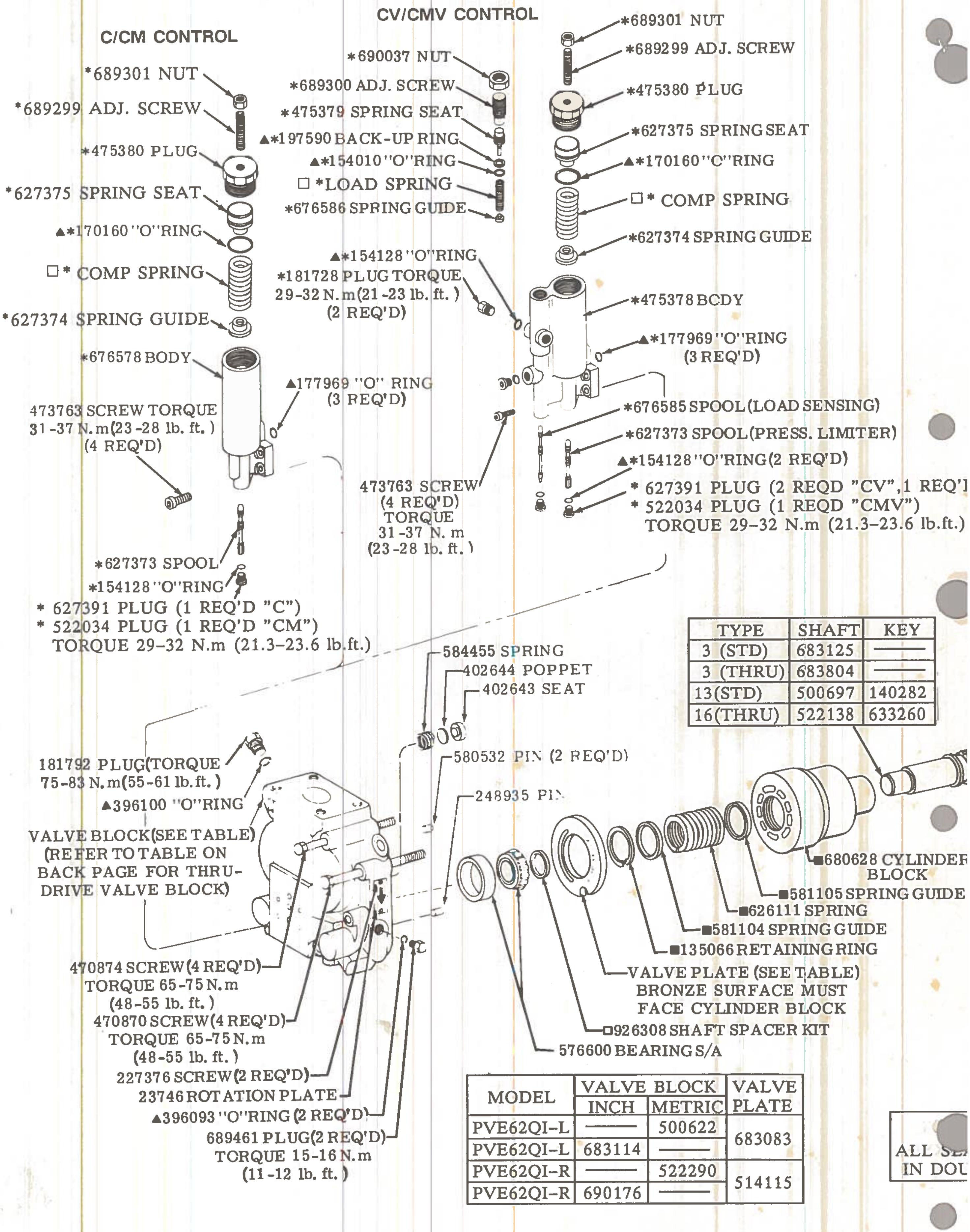

C/CM CONTROL
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O" RING
☐* COMP SPRING
*627374 SPRING GUIDE
*676578 BODY
473763 SCREW TORQUE 31-37 N.m (23-28 lb. ft.) (4 REQ'D)
▲177969 "O" RING (3 REQ'D)
*627373 SPOOL
*154128 "O" RING
* 627391 PLUG (1 REQ'D "C")
* 522034 PLUG (1 REQ'D "CM")
TORQUE 29–32 N.m (21.3–23.6 lb.ft.)
CV/CMV CONTROL
*690037 NUT
*689300 ADJ. SCREW
*475379 SPRING SEAT
▲*197590 BACK-UP RING
▲*154010 "O" RING
☐ *LOAD SPRING
*676586 SPRING GUIDE
▲*154128 "O" RING
*181728 PLUG TORQUE 29-32 N.m (21-23 lb. ft.) (2 REQ'D)
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O" RING
☐* COMP SPRING
*627374 SPRING GUIDE
*475378 BODY
▲*177969 "O" RING (3 REQ'D)
*676585 SPOOL (LOAD SENSING)
*627373 SPOOL (PRESS. LIMITER)
▲*154128 "O" RING (2 REQ'D)
* 627391 PLUG (2 REQD "CV", 1 REQ'
* 522034 PLUG (1 REQD "CMV")
TORQUE 29–32 N.m (21.3–23.6 lb.ft.)
473763 SCREW (4 REQ'D) TORQUE 31-37 N. m (23-28 lb. ft.)
584455 SPRING
402644 POPPET
402643 SEAT
580532 PIN (2 REQ'D)
248935 PIN
181792 PLUG (TORQUE 75-83 N.m (55-61 lb.ft.)
▲396100 "O" RING
VALVE BLOCK (SEE TABLE) (REFER TO TABLE ON BACK PAGE FOR THRU-DRIVE VALVE BLOCK)
470874 SCREW (4 REQ'D) TORQUE 65-75 N.m (48-55 lb. ft.)
470870 SCREW (4 REQ'D) TORQUE 65-75 N.m (48-55 lb. ft.)
227376 SCREW (2 REQ'D)
23746 ROTATION PLATE
▲396093 "O" RING (2 REQ'D)
689461 PLUG (2 REQ'D) TORQUE 15-16 N.m (11-12 lb. ft.)
■680628 CYLINDER BLOCK
■581105 SPRING GUIDE
■626111 SPRING
■581104 SPRING GUIDE
■135066 RETAINING RING
VALVE PLATE (SEE TABLE) BRONZE SURFACE MUST FACE CYLINDER BLOCK
☐926308 SHAFT SPACER KIT
576600 BEARING S/A

TYPE	SHAFT	KEY
3 (STD)	683125	———
3 (THRU)	683804	———
13(STD)	500697	140282
16(THRU)	522138	633260

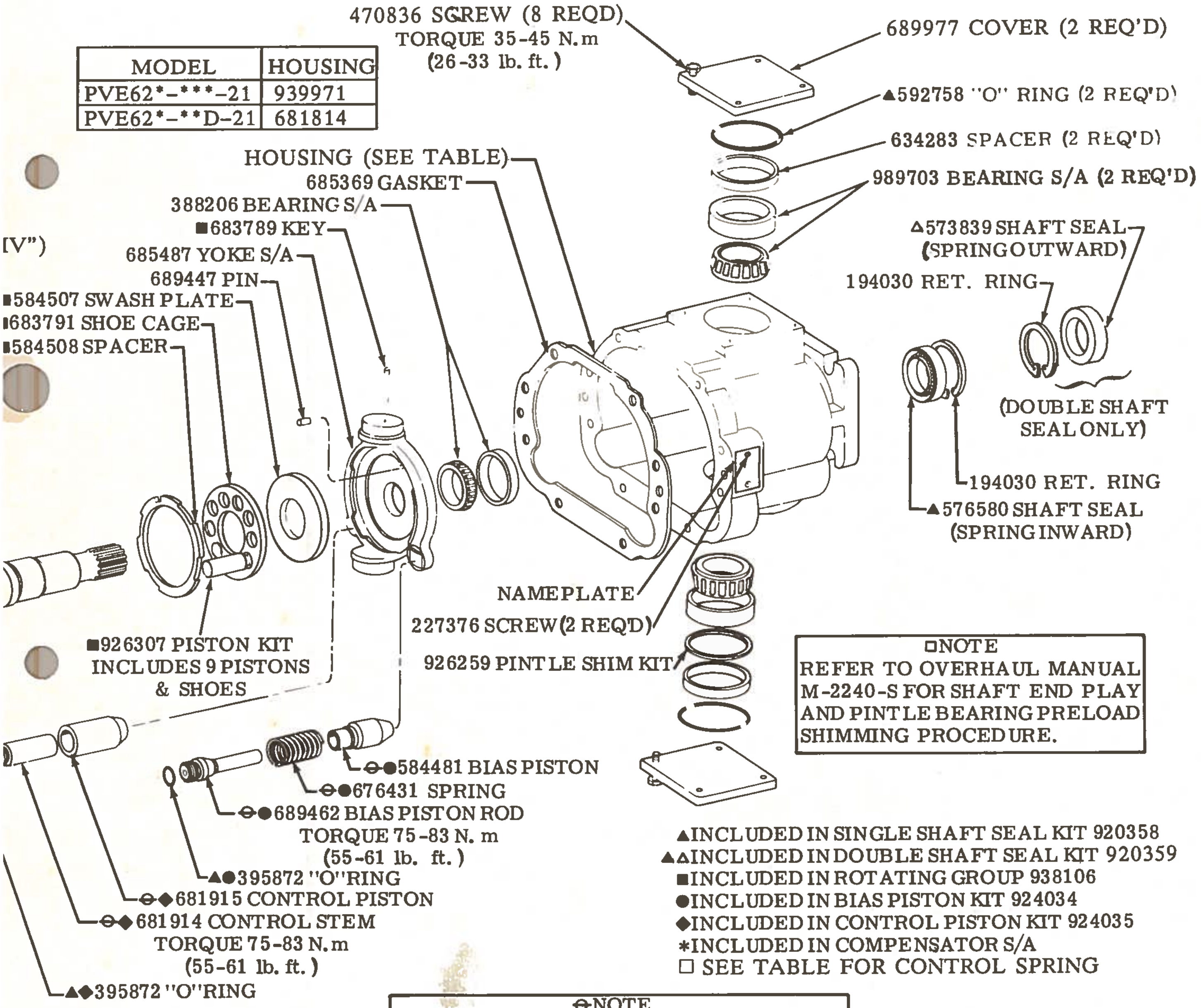
MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE62QI–L	———	500622	683083
PVE62QI–L	683114	———	
PVE62QI–R	———	522290	514115
PVE62QI–R	690176	———	

ALL SE
IN DOU

PVE62QI*-**-(M)(D)-21-C(*)V-21

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		□ COMP	□ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)

MODEL	HOUSING
PVE62*-***-21	939971
PVE62*-**D-21	681814



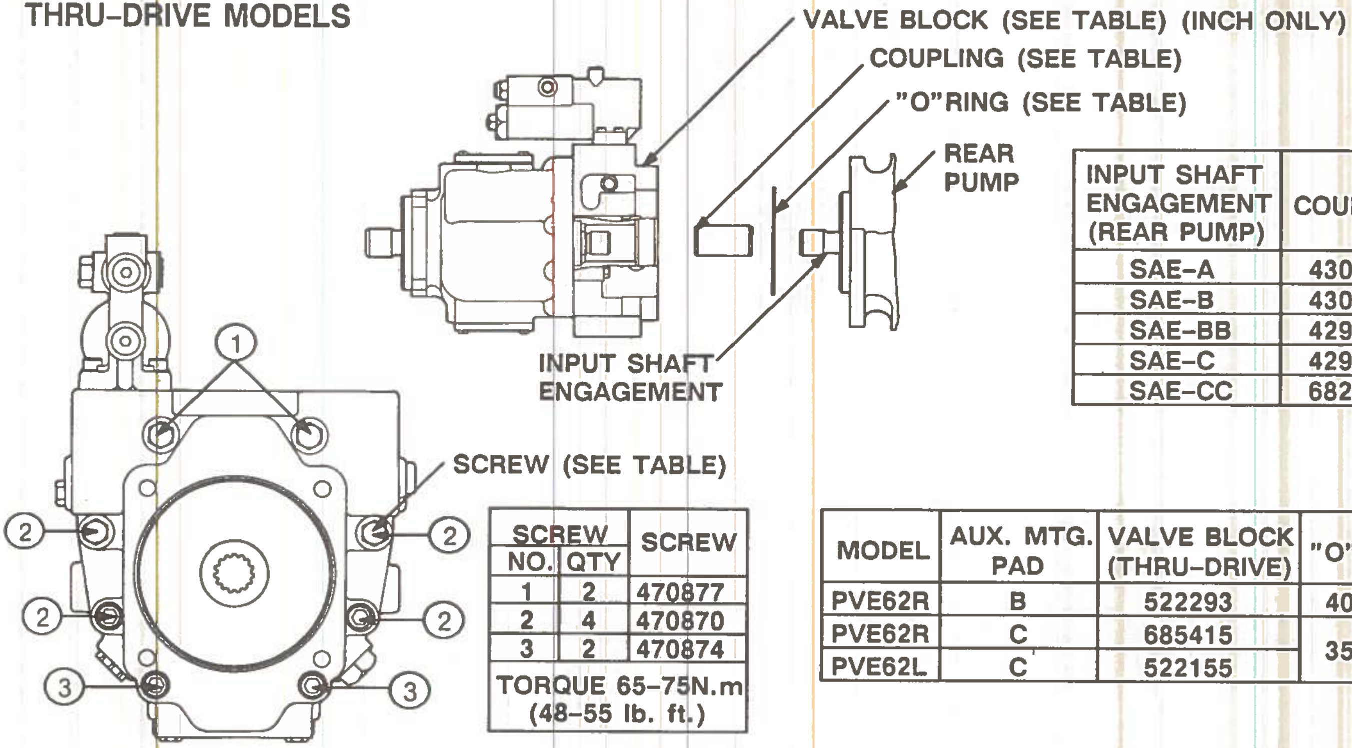
□NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

▲INCLUDED IN SINGLE SHAFT SEAL KIT 920358
▲△INCLUDED IN DOUBLE SHAFT SEAL KIT 920359
■INCLUDED IN ROTATING GROUP 938106
●INCLUDED IN BIAS PISTON KIT 924034
◆INCLUDED IN CONTROL PISTON KIT 924035
*INCLUDED IN COMPENSATOR S/A
□ SEE TABLE FOR CONTROL SPRING

TE
ARKED ▲ INCLUDED
SHAFT SEAL KIT.

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.

THRU-DRIVE MODELS



INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	430359
SAE-B	430360
SAE-BB	429368
SAE-C	429369
SAE-CC	682898

SCREW		SCREW
NO.	QTY	
1	2	470877
2	4	470870
3	2	470874
TORQUE 65-75N.m (48-55 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK (THRU-DRIVE)	"O"RING
PVE62R	B	522293	401525
PVE62R	C	685415	353264
PVE62L	C	522155	

MODEL CODE BREAKDOWN

P V E 62(QI) * - * * (M) (D) - 21 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

62 - 62 GPM @ 1800 RPM (8.0 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

3 - SPLINED
13 - STRAIGHT KEYED
16 - STRAIGHT KEYED

9 PORT DESIGNATION

BLANK - 4 BOLT FLANGE (INCH)
M - METRIC

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

Litho in U.S.A.

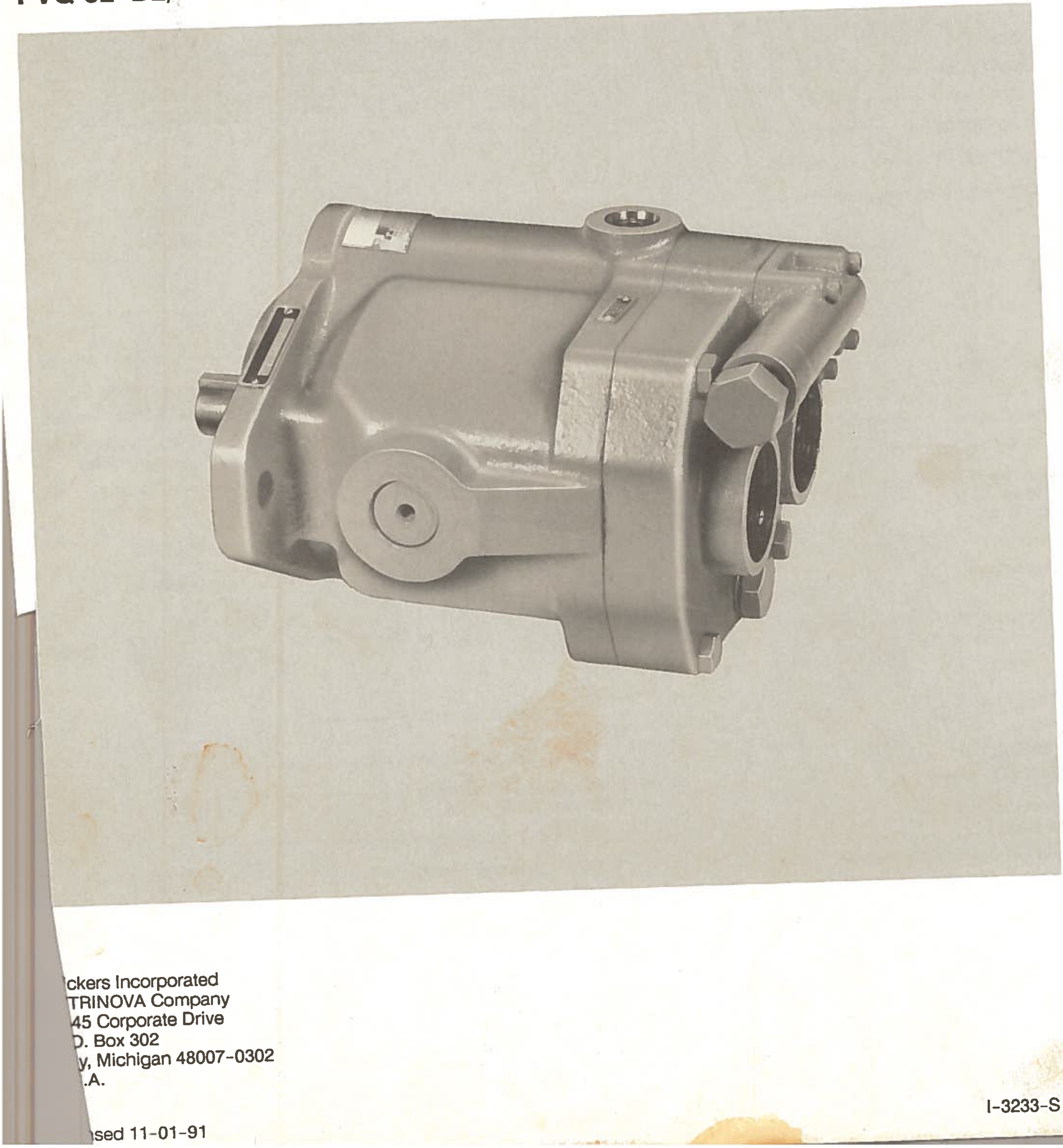
15

Service Data

Low Noise Industrial Piston Pump

2-6

PVQ 20–B2/MB * *** – ** * * – 10 C** *** *** * – 11/12/20
PVQ 32–B2/MB * *** – ** * * – 10 C** *** *** * – 11/12/20



ckers Incorporated
TRINOVA Company
45 Corporate Drive
D. Box 302
y, Michigan 48007-0302
.A.

I-3233-S

sed 11-01-91

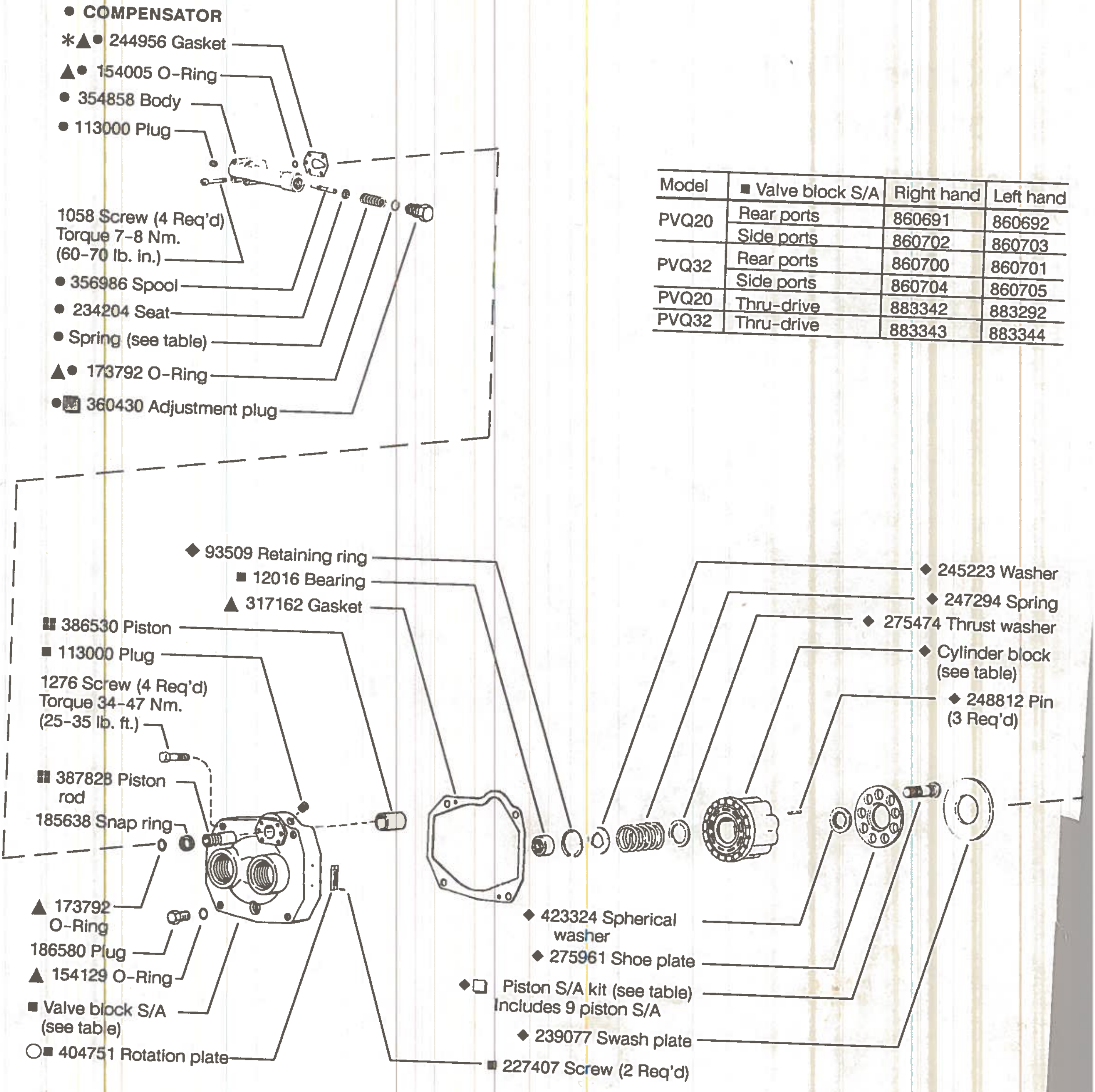
✱ CAUTION

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

● NOTE:

Compensator shown for left hand shaft rotation. Rotate 180° for right hand shaft rotation.

Model	■ Valve block S/A	Right hand	Left hand
PVQ20	Rear ports	860691	860692
	Side ports	860702	860703
PVQ32	Rear ports	860700	860701
	Side ports	860704	860705
PVQ20	Thru-drive	883342	883292
PVQ32	Thru-drive	883343	883344



Model	◆ Cylinder block	❑◆ Piston S/A kit	◆ Rotating group kit
PVQ20	321703	942047	938276
PVQ32	260860	941887	938273

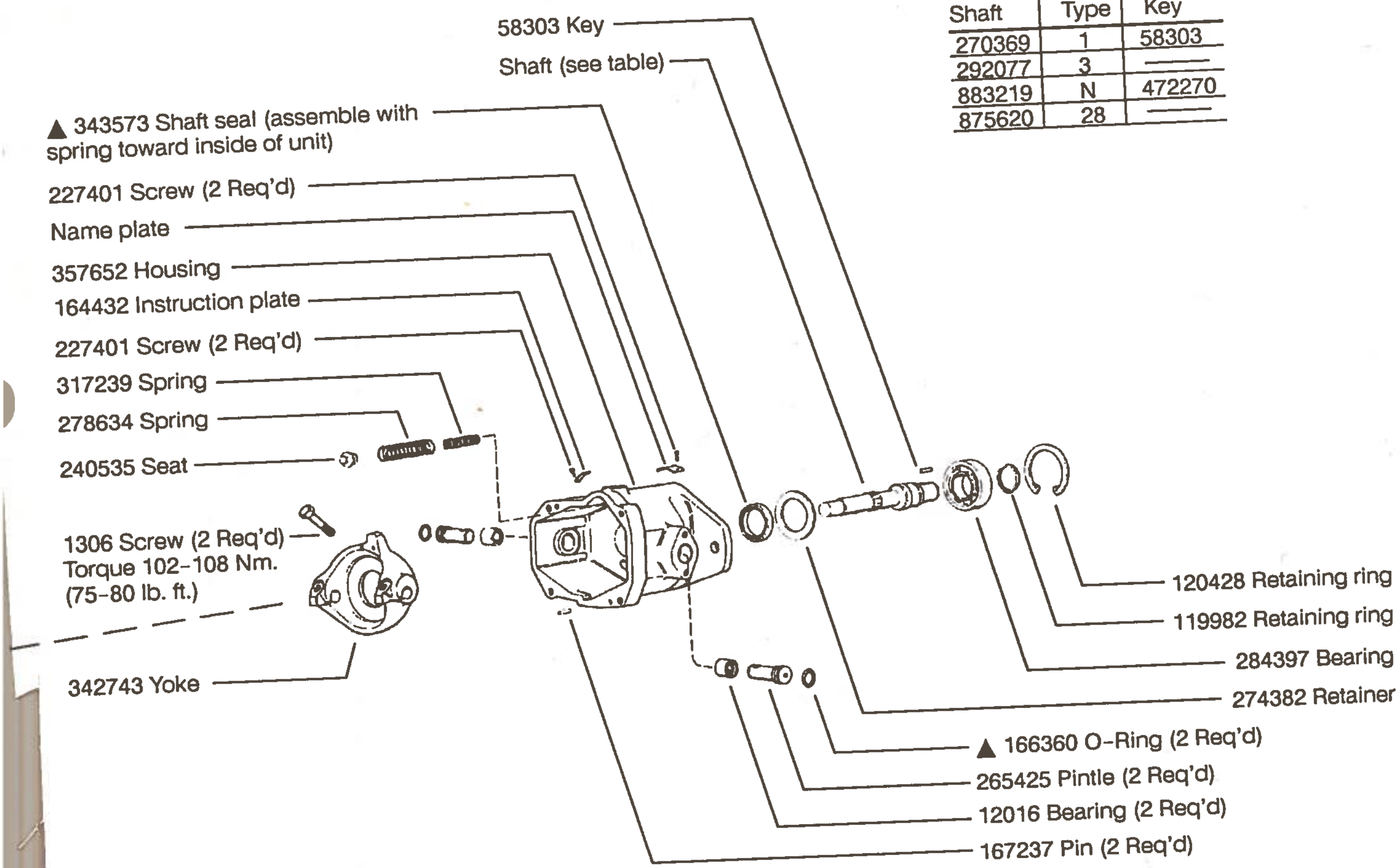
CAUTION
Model PVQ32C compensator pressure adjustment shall not exceed 2000 psi

10 NOTE: See model code for pressure range settings of individual compensator kits.

Model	● Comp. kit	● Comp. Spring	● Load Sense Spring
PVQ**C	942158	239371	———
PVQ**CM	942159	265693	———
PVQ**CG	942480	239371	———
PVQ**FCG	941353	265693	———
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

Non Thru-Drive Shaft

Shaft	Type	Key
270369	1	58303
292077	3	———
883219	N	472270
875620	28	———



Thru-Drives

5 Model	Shaft	Coupling	Snap Ring	O-Ring	7 Input Type
PVQ**A9	883302	426770	223172	351776	1 Str. Keyed SAE B
PVQ**A11	860501	577937	92757		

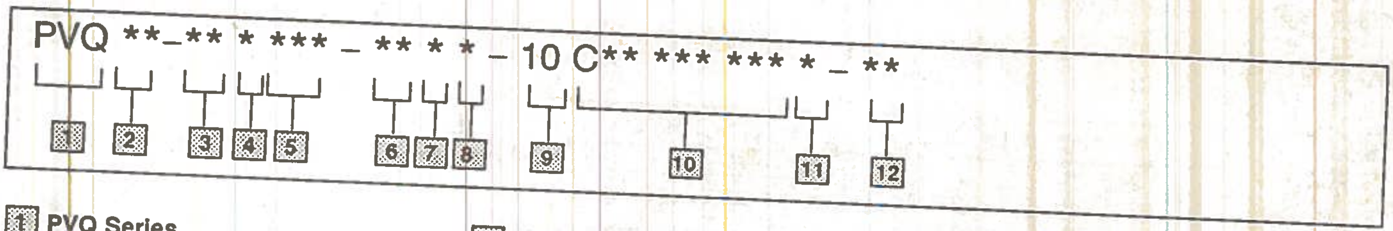
Couplings, coupling retaining rings, O-rings, capscrews and washers must be ordered separately to mount rear pump.

NOTE:
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

○ NOTE:
Rotation plate shown for right hand shaft rotation. Assemble on opposite side of valve plate for left hand rotation.

▲ Standard seal kit 919682
F3 equivalent seal kit 919686
● Compensator kit (see table)
■ Valve block S/A (see table)
◆ Rotating group kit (see table)
☐ Piston S/A kit (see table)
▪ Piston/Rod S/A kit 942327

Model Code



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement
(CC/Rev & Pressure ratings)

20 – 20 CC/Rev (1.28 CIR)
210 bar (3000 psi)
32 – 32 CC/Rev (2.01 CIR)
140 bar (2000 psi)

3 Mounting flange

B2 – SAE "B" 2-bolt
MB – ISO 3019/2 "B" 2-bolt (available with "N" drive shaft only)

4 Rotation
(viewed from shaft end)

R – Right hand (CW) (standard)
L – Left hand (CCW) (optional)

5 Thru drive
(without coupling) Available with side ports only.

Blank – No thru drive
A9 – SAE "A" 2-bolt with 9T shaft
A11 – SAE "A" 2-bolt with 11T shaft

6 Ports
(type and location)

SE – SAE O-Ring rear port, 1.625 inch (Inlet & Outlet) (standard)
SS – SAE O-Ring side port, 1.625 inch (Inlet & Outlet) (optional)

7 Shafts
(input)

1 – Straight keyed SAE "B" modified 2.31 inch long
3 – Splined SAE "B" modified 13T, 16/32 DP major dia. fit
N – ISO 3019/2 short straight keyed (available with "MB" mounting only) Not available on thru-drives
28 – 26 Tooth splined shaft (Vickers) Used to mount PVQ20/32 on PVQ40/45 "B26" thru drive

8 Seals

S – Buna N (standard)
F – Fluorocarbon (optional)

9 Pump design number

10 – First design

10 Control type

C** – Pressure compensator, PVQ20: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ32: Std. model is C14, indicating factory setting of 140 bar (2000 psi). Range is 02-14 in tens of bar (350-2000 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
C**V**B – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice. Example: C21V11B indicates compensator with 210 bar pressure setting and 11 bar load sense differential.
C**V**P – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
C**VC**B – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
C**VC**P – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD** – Electric dual range compensator. PVQ20: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ32: Std. model is CD1407, indicating settings of 140 and 70 bar, adjustment ranges are 20-140 bar (high) and 20-100 bar (low).

11 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

12 Control design

11 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

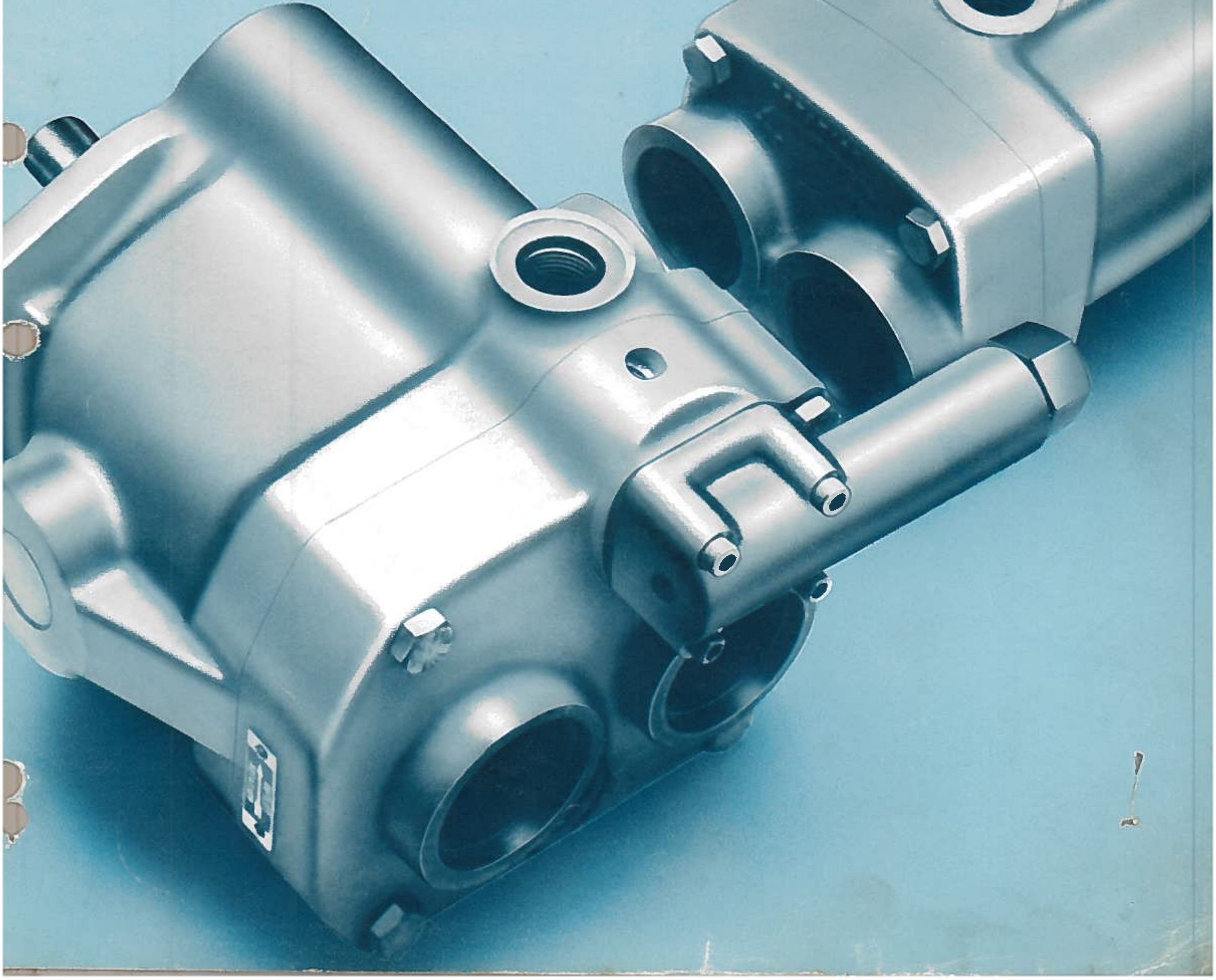
10

VICKERS®

28

B Series Piston Pumps & Motors

FOR INDUSTRIAL EQUIPMENT



General Description

Pumps

Vickers' B Series pumps are inline fixed and variable displacement units, available in a range of sizes with a selection of optional controls for maximum operational flexibility. These reliable "workhorses" offer the combined, time-tested advantages of efficient performance plus high operating reliability because of their simple design and rugged components. In addition, B Series pumps are equally at home with both standard fluids and high water base hydraulic fluids.

Motors

The B Series piston family also includes fixed and variable displacement motors. When paired with B Series pumps, they provide a complete hydraulic drive system. All motors are available as fixed displacement units; variable displacement units are available in the two smaller sizes, with handwheel or lever controls.

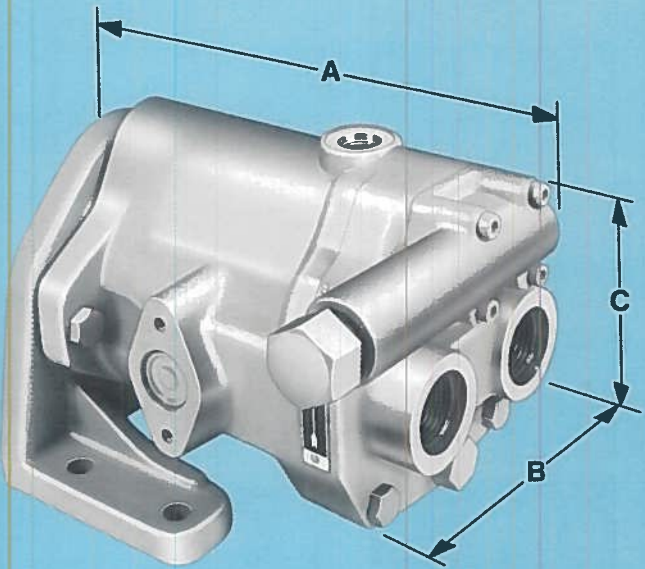
Features and Benefits

Reliable, Compact Design

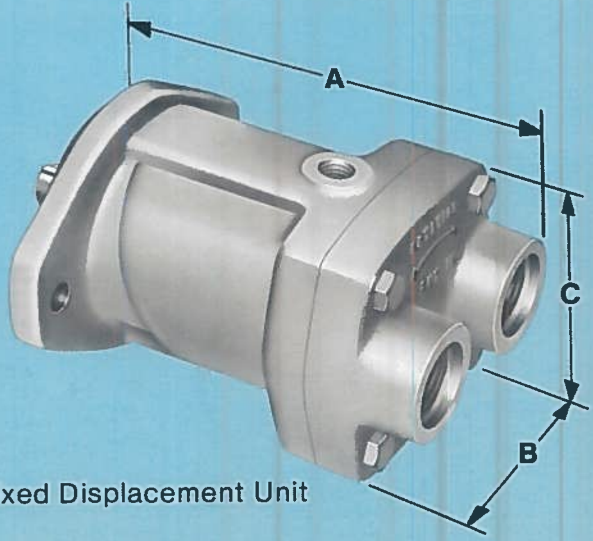
Rugged construction and a minimum number of parts increase pump reliability and permit simple field servicing without disturbing the pump mounting.

High Performance

At rated speeds and pressures, these pumps demonstrate approximately 97% volumetric efficiency and 85% overall efficiency. Pressure compensated, variable delivery models can be applied to reduce heat generation. This minimizes the need for cooling equipment and reduces the size of the reservoir required. Variable displacement pumps can also be used in energy conservation applications to tailor flows to work requirements.



Variable Displacement Unit



Fixed Displacement Unit

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Multi-Fluid Capability

Versatile B Series pumps operate on a variety of hydraulic fluids. These include oil, invert emulsions, phosphate esters, water glycols and high water base fluids (HWBF). In today's cost-conscious environment, this versatility provides operational alternatives and reduces the need for separate pump stocks.

Pump Controls

Several controls are available for variable displacement pumps, depending on the model. These include pressure compensator, adjustable maximum displacement, overcenter displacement and manual or stem servo controls. Also, lever or handwheel overcenter controls, load sensing with pressure limiting and electrohydraulic servo controls are available on some models.

Mountings and Port Connections

Foot mountings are available on all models. SAE straight threads are standard on all units up to 20 gpm, fixed displacement models, and up to 29 gpm on variable displacement models. SAE 4-bolt flange ports are standard on larger sizes. In addition to the standard port locations, side ports can be provided on all variable displacement pumps through the 45 gpm size. Thru-shaft configurations are also available on variable pumps with side ports, through the 45 gpm size.

PRODUCT TYPE	MODEL SERIES	DELIVERY (GPM) @ 1800 RPM	MAXIMUM SPEED (RPM)	MAXIMUM PRESSURE (PSI) **	SOUND LEVEL *** (dbA) @ FULL FLOW, 1800 RPM & MAX. PRESS.	DIMENSIONS (INCHES) *			WEIGHT (LBS.) *	INSTALLATION DRAWING NUMBER
						A (LENGTH)	B (WIDTH)	C (HEIGHT)		
FIXED PUMPS	PFB5	5	3600	3000	71	7.35	6.00	4.06	11	507725
	PFB10	10	3200	3000	76	8.98	6.88	5.25	21	507727
	PFB20	20	2400	2500	●	10.31	6.88	6.31	41	507729
	PFB45	45	2200	3000	91	13.22	8.36	8.16	73	507800
	PFB90	90	1800	3000	93	16.06	10.00	9.72	146	507812
VARIABLE PUMPS	PVB5	5	3600	3000	71	8.72	7.13	5.18	16	508300B
	PVB6	6	3200	2000	69	8.72	7.13	5.18	16	508300B
	PVB10	10	3200	3000	76	10.50	7.36	5.81	31	508400A
	PVB15	15	3000	2000	76	10.50	7.36	5.81	31	508400A
	PVB20	20	2400	3000	81	11.62	8.88	7.44	57	508500B
	PVB29	29	2400	2000	81	11.62	8.88	7.44	57	508500B
	PVB45	45	2200	3000	91	16.00	11.76	12.50	210	508890
	PVB90	90	1800	3000	93	18.31	12.96	11.95	228	509020
FIXED MOTORS	MFB5	5	3600	3000	●	7.35	5.00	5.32	11	520300
	MFB10	10	3200	3000	●	8.98	5.00	7.12	21	520305
	MFB20	20	2400	2500	●	10.31	6.75	7.13	41	520310
	MFB29	29	2400	2000	●	11.88	8.36	8.50	41	520315
	MFB45	45	2200	3000	●	13.22	8.56	8.50	73	520325
VARIABLE MOTORS	MVB5	5	3600	3000	●	8.19	5.56	5.18	16	273831
	MVB10	10	3200	3000	●	9.75	7.38	5.84	31	273838

* Dimensions and weights with flange mounting; for foot mounting, lever and handwheel controls, or other options, consult installation drawing.

** Unit service life is individual to each application. Applications which require continuous operation at maximum pressure will likely result in shortened service life.

*** Sound levels recorded per NFPA standards at 3 ft.

● Consult Vickers representative if assistance is needed.

NOTE: For recommended speeds and pressures when using fluids other than oil, consult Data Sheet 507000.

Model Code – *Fixed Pumps and Motors*

F3 - PFB 5 - F R Y - 20

1 2 3 4 5 6 7

1 FLUID COMPATIBILITY

F3 = Fluorocarbon seals for use with phosphate esters.
(Omit for all other fluids)

2 SERIES DESIGNATION

PFB = fixed pump
MFB = fixed motor

3 NOMINAL FLOW RATING @ 1800 RPM

PFB = 5, 10 20, 45 or 90 gpm
MFB = 5, 10 20, 29 or 45 gpm

4 MOUNTING

F = foot bracket
(Omit for flange mounting)
For foot mounting, see note.

5 ROTATION (VIEWED FROM SHAFT END)

R = right hand only
L = left hand only
U = either direction (motors only)

6 OPTIONAL FEATURES

F = SAE 4-bolt flange ports
Y = standard shaft
(Omit for short shaft)

7 DESIGN NUMBER

Subject to change.

NOTE: Foot mounting kits available.
Use No. FB-A-10 on PFB5/6 & PVB5/6/6A
Use No. FB-B-10 on PFB10/15 & PVB10/15
Use No. FB-C-10 on PFB20/29 & PVB20/29/45A

Model Code – *Variable Pumps and Motors*

F3 - PVB 6 - F R S F X - * - 20 - C - 11

1 2 3 4 5 6 7 8 9 10 11 12

1 FLUID COMPATIBILITY

F3 = Fluorocarbon seals for use with phosphate esters.
(Omit for all other fluids)

2 SERIES DESIGNATION

PVB = variable pump
MVB = variable motor

3 NOMINAL FLOW RATING @ 1800 RPM

PVB = 5, 6, 10, 15, 20, 29, 45 or 90 gpm
MVB = 5 or 10 gpm

4 MOUNTING

F = foot bracket
(Omit for flange mounting)
For foot mounting, see note.

5 ROTATION (VIEWED FROM SHAFT END)

R = right hand only
L = left hand only
U = either direction (motors only)

6 DISPLACEMENT

S = single side of center (pressure compensated models)
D = both sides of center (handwheel & lever models)

7 PORT CONNECTIONS

F = SAE 4-bolt flange

8 OPTIONAL FEATURES

W = side ports
X = thru-shaft

9 DRIVE SHAFT

Models 20/29/45/90 - Omit for standard
Models 5/6/10/15 = Y for standard (omit for short shaft)

10 DESIGN NUMBER

Subject to change.

11 CONTROL OPTIONS

C = pressure compensated, 250-2000 psi (6 or 29 gpm) or 250-3000 psi (all others)
CVP = load sensing with pressure limiter
CM = pressure compensated, 250-1500 psi
CC = pressure compensated with adjustable max. stop, 300-3000 psi *
CD = elec. dual range compensator *
CCD = elec. dual range compensator with adjustable max. stop *
CG = remote adjustable compensator
H = handwheel
M = lever
V = no control

* not available with thru-shaft

12 CONTROL DESIGN NUMBER

Subject to change.

A TRINOVA COMPANY

Vickers, Incorporated
1401 Crooks Road, Troy, MI 48084
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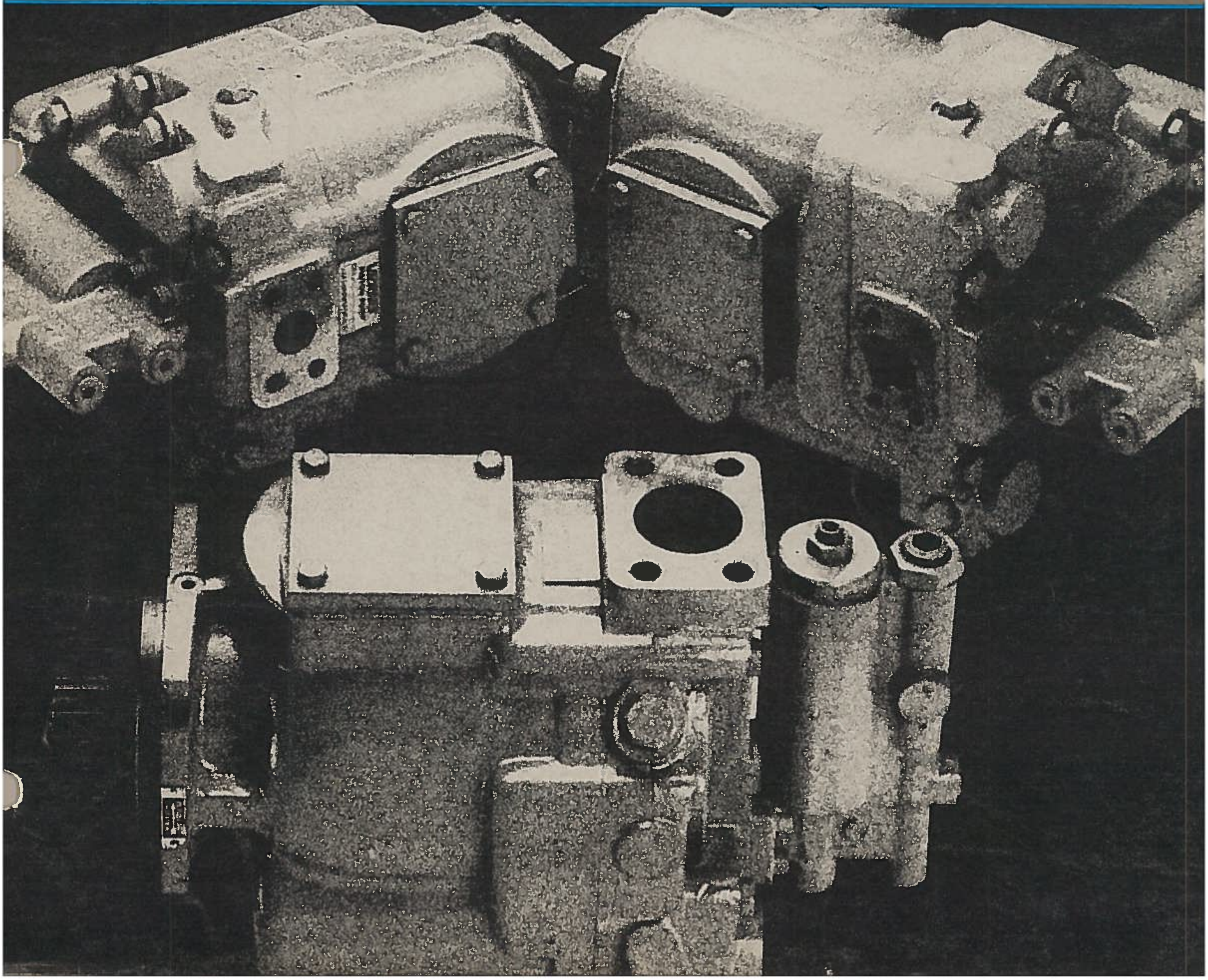
23

E SERIES PISTON PUMPS

SIZES 27 — 62



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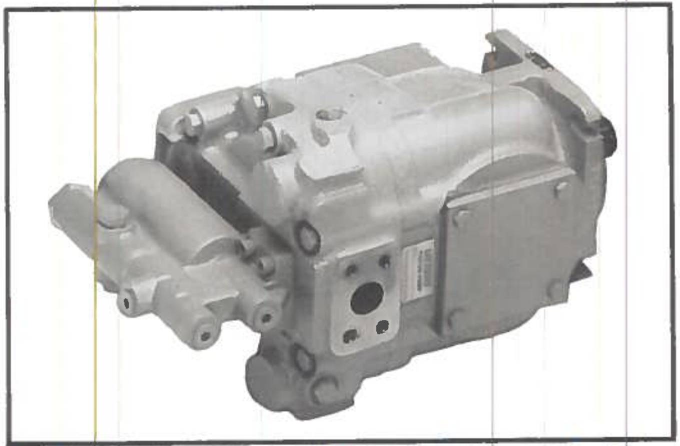
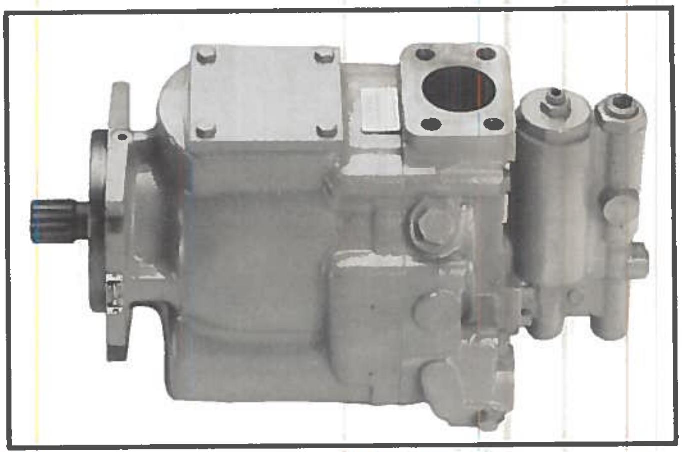
MODEL CODE 13

PVE27
STANDARD VERSION



- 85 LPM @ 1500 RPM • 27 GPM @ 1800 RPM

PVE35
STANDARD VERSION



- 110 LPM @ 1500 RPM • 35 GPM @ 1800 RPM

OUTSTANDING PERFORMANCE UNMATCHED DURABILITY

Proven Design Features

Vickers high flow, high performance pump models in the E Series are a new family of variable displacement, inline piston units which incorporate the proven design, quality manufacturing techniques and operating features of other Vickers piston pumps. These new pumps fill the need between existing high pressure 5000 psi series and the popular 3000 psi series. They've been specially designed to meet the 3600 psi continuous duty performance requirements of new generation equipment designs.

The models in this series are efficient, reliable pumps, with a selection of optional controls for maximum operational flexibility. Designed specifically for strenuous application, they provide the productivity gains and controllability improvements desired in earthmoving, construction and all other energy-conscious mobile and industrial markets. As with all Vickers products, these pumps have been fully laboratory tested and field proven.

High Efficiency

E Series pumps handle today's higher speeds and pressures with high efficiency. Typical volumetric efficiency exceeds 95%. These pumps exceed the critical demands of modern vehicle performance.

Low Maintenance, High Productivity

Simplified, heavy duty construction provides an extremely reliable pump. The replaceable wafer-type valve plate incorporates the pump's timing and provides the stationary surface on which the cylinder block rotates. Large, antifriction pintle bearings support the yoke, complementing its strength. The drive shaft has a diameter up to one and one-half times that of other similar models in the field, and is designed for minimum deflection at its highest loads. Shaft rigidity assures optimum alignment and lubrication of the bearings, thus providing long bearing life. Pump life is further enhanced by the use of large, high strength, tapered roller bearings.

The design simplicity of these units reduces the potential for failure and offers a large margin of overall integrity. Individual pump components are sized for maximum uptime, ruggedness and service life. Designed-in strength promotes increased productivity and lowers the cost of ownership.

Completely Serviceable

These E Series pumps have been designed for a high degree of serviceability. Rapid and complete service of the pumping elements can be achieved by using modular kits which replace the swashplate, rotating group and valve plate.

Application Flexibility

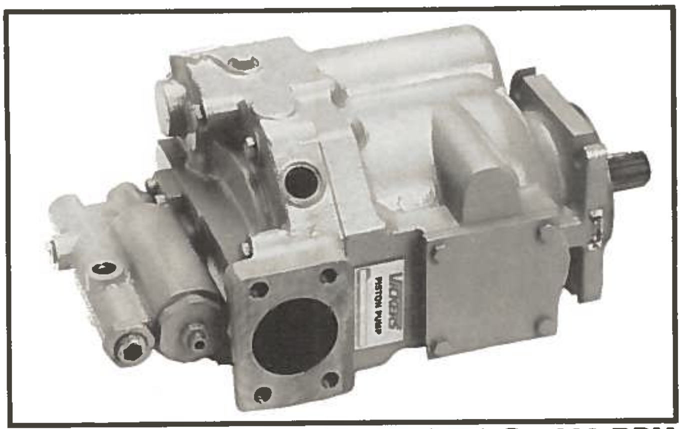
Four basic displacements in this series are available in single, tandem or thru-drive configurations. Tandem models can be any combination of the four displacements. Thru-drive models are available for directly mounting a second pump, either fixed or variable displacement, on a two-bolt SAE "A", "B", "C" or four-bolt SAE "C" mounting pad. Mounting bolts for the second pump can be either SAE or metric.

The high strength, cast iron housing has a standard SAE four-bolt "C" mounting flange and drive shaft for maximum durability. Thru-drive models have correspondingly larger shafts to provide full power to the second pump. Drive shafts are available in either straight key or spline versions.

The greatest versatility is offered by the wide variety of controls available to match your circuit needs while conserving the greatest amount of power. Basic pressure-limiting compensator controls are standard, and popular load-sensing, torque sensing and torque summation controls can be added to customize specific applications.

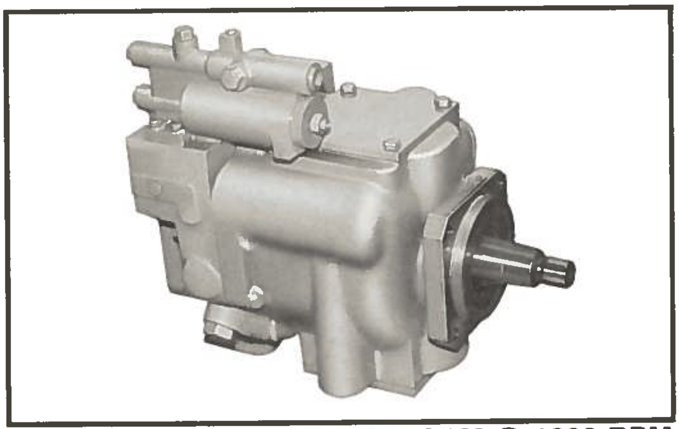
Inlet and pressure ports are the dependable four-bolt split flange type, and are available in standard SAE or metric ISO dimensions.

PVE47
STANDARD VERSION



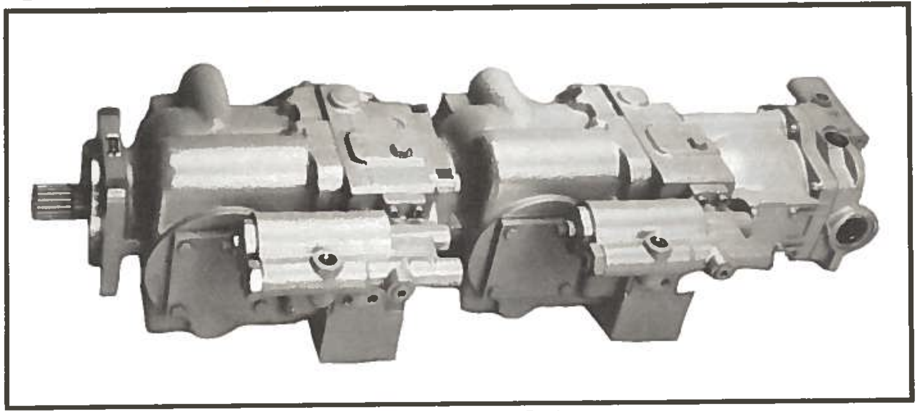
- 148 LPM @ 1500 RPM • 47 GPM @ 1800 RPM

PVE62
SIDE MOUNTED CONTROL VERSION



- 195 LPM @ 1500 RPM • 62 GPM @ 1800 RPM

PVE47 / PVE47 / PVE19



- TYPICAL THRU-DRIVE COMBINATION

HIGHER PRESSURE RATINGS COMPLETE VERSATILITY

Optional Control Location

For even greater flexibility of installation in today's compact machinery design, the compensator controls can be rear-mounted to provide additional side clearance, or side mounted to reduce overall length. The same high levels of control performance are maintained in either configuration.

Quieted Versions

Designed specifically for the noise sensitive environments, the "quiet" option will deliver full power while maintaining minimum sound levels. Available with the complete range of control options, thru-drive or standard, all of the versatile features are available in these quieted models to match any of today's in-plant application requirements.

Case Pressure Protection

An integral relief valve limits the pump case transient pressures to a small differential higher than the inlet pressure. Flow from this valve is returned directly to the pump inlet.

STANDARD VERSION

Pump Model	Displacement mL/Rev. (Cu. In./Rev.)	Rated Pressure Bar (PSI)	Maximum Pressure Bar (PSI)	Rated Speed		
				−.17 Bar (2.5 PSI) (5″ Hg) Inlet	0 Inlet	.5 Bar (7 PSI) Inlet
PVE27	57.4 (3.5)	250 (3625)	276 (4000)	2000	2400	3000
PVE35	73.7 (4.5)			1850	2200	2750
PVE47	98.3 (6.0)			1750	2100	2600
PVE62	131.1 (8.0)			1650	2000	2500

QUIETED VERSION

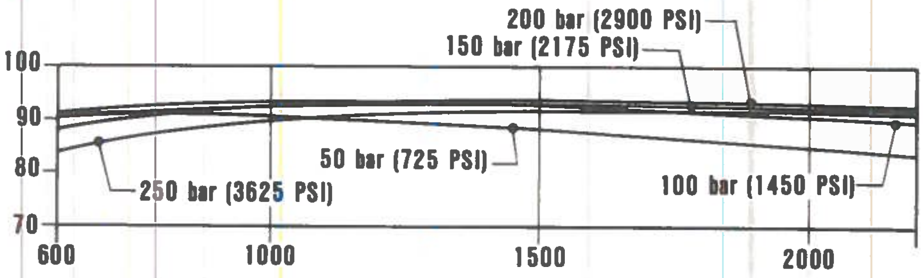
PVE27QI	57.4 (3.5)	250 (3625)	276 (4000)	1500	1800	1800
PVE35QI	73.7 (4.5)			1500	1800	1800
PVE47QI	98.3 (6.0)			1500	1800	1800
PVE62QI	131.1 (8.0)			1200	1500	1800

TYPICAL PERFORMANCE

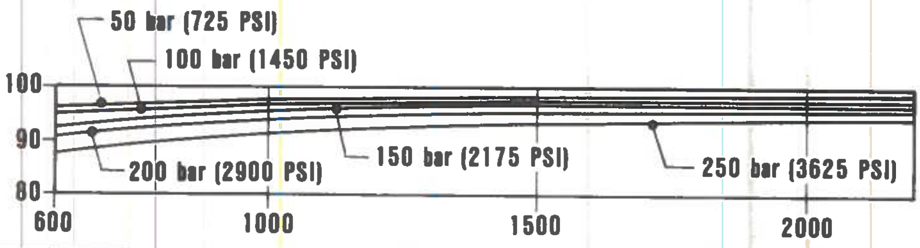
Oil Type: SAE 10W; Oil Temp: 49°C (120°F);
Inlet Pressure: 0 PSI

PVE27

OVERALL EFFICIENCY (%)

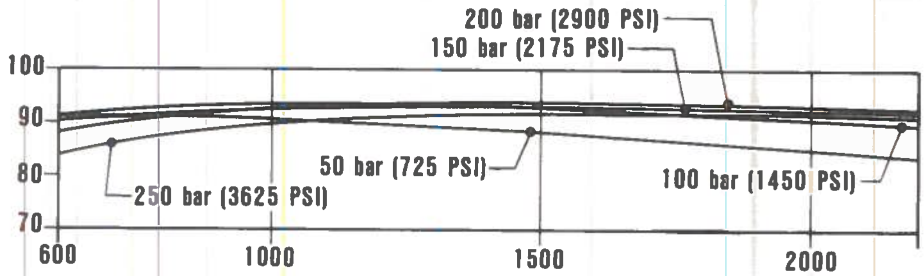


VOLUMETRIC EFFICIENCY (%)

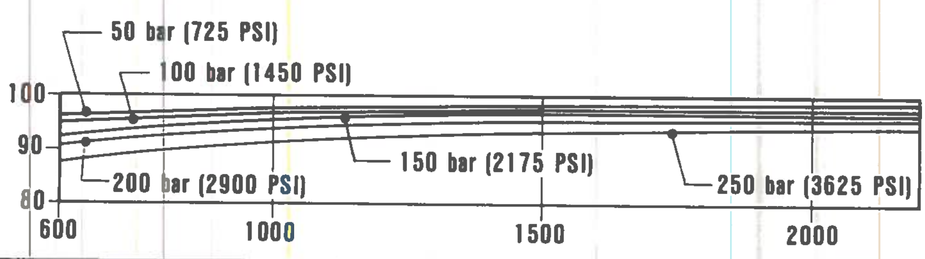


PVE35

OVERALL EFFICIENCY (%)

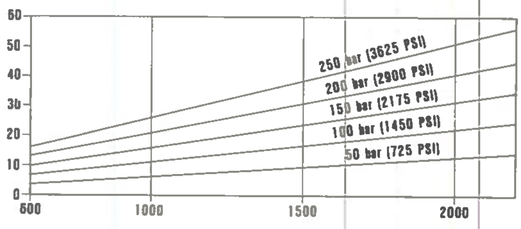


VOLUMETRIC EFFICIENCY (%)



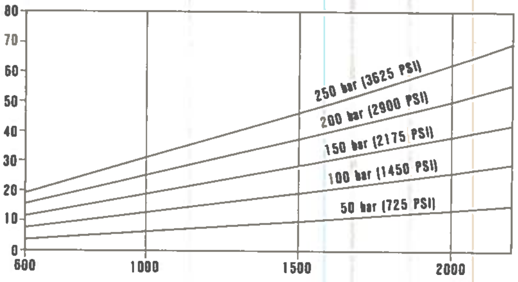
PVE27

INPUT POWER (kw)



PVE35

INPUT POWER (kw)



Application Data

Maximum temperature
Continuous, 93°C (200°F)
Intermittent, 104°C (220°F)

Minimum Inlet Vacuum
125 mm (5 in.) Hg

Maximum Case Pressure
0.5 Bar (7 psi)

Rotation

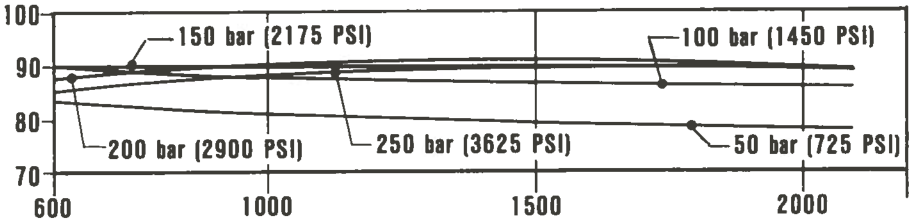
Shaft rotation of pumps can be either clockwise or counterclockwise, as viewed from the shaft end.

Filtration

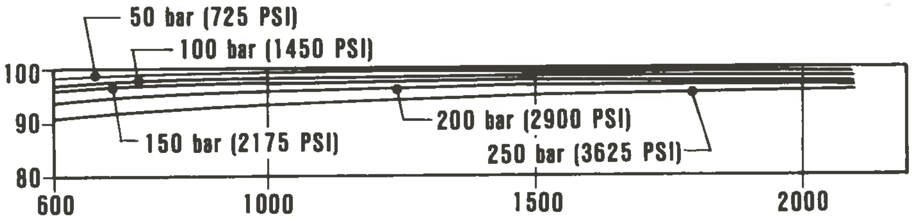
For satisfactory service life, provide full flow filtration to maintain total system cleanliness. Piston pump inlet oil should meet ISO code 19/15. Consult your Vickers representative for filter selections from OFR and OFRS series.

PVE47

OVERALL EFFICIENCY (%)

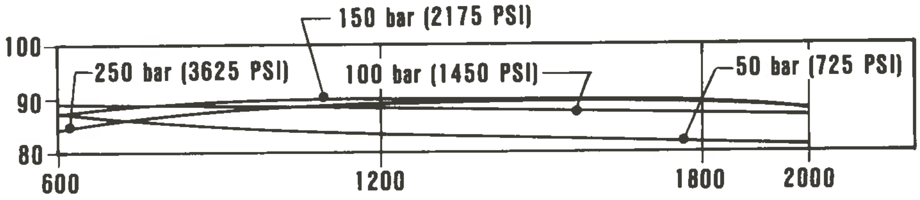


VOLUMETRIC EFFICIENCY (%)

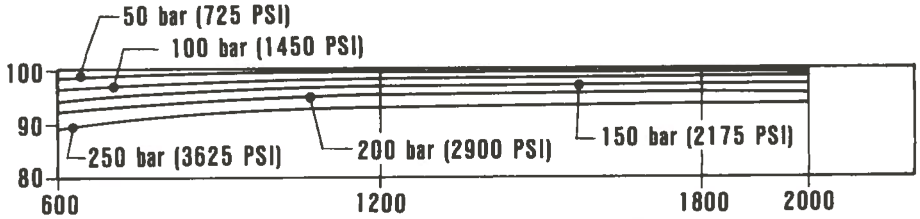


PVE62

OVERALL EFFICIENCY (%)

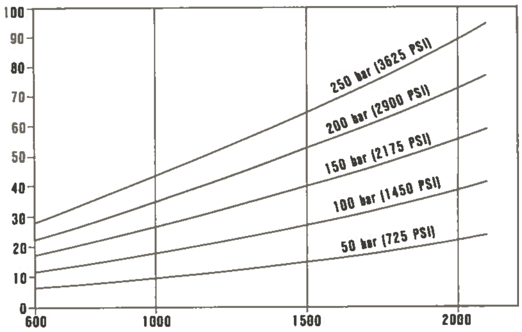


VOLUMETRIC EFFICIENCY (%)



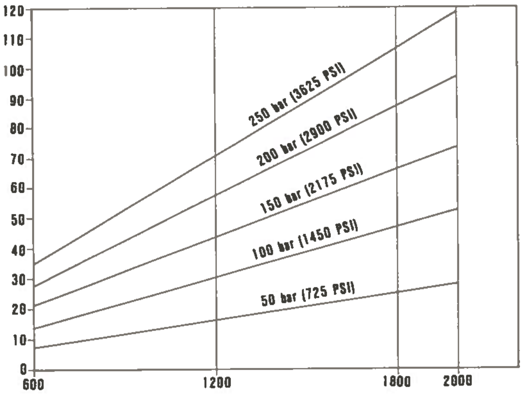
PVE47

INPUT POWER (kw)



PVE62

INPUT POWER (kw)



Fluids

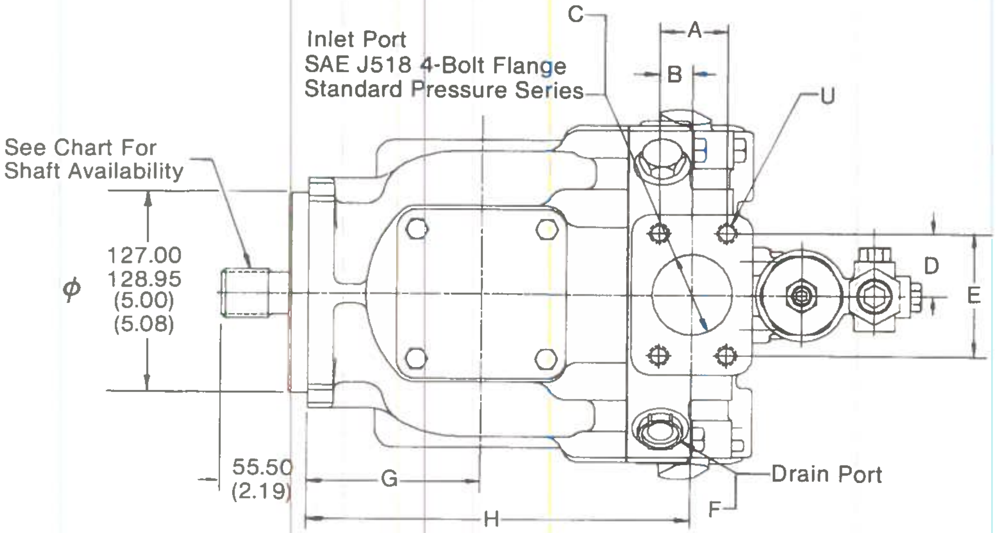
These pumps are qualified for use on petroleum based fluids operating within a viscosity range of 16 cSt (80 SUS) and 40 cSt (180 SUS). The fluid used should be in accordance with Vickers Fluid Recommendations Sheets I-286-S (industrial applications) or M-2950-S (mobile applications).

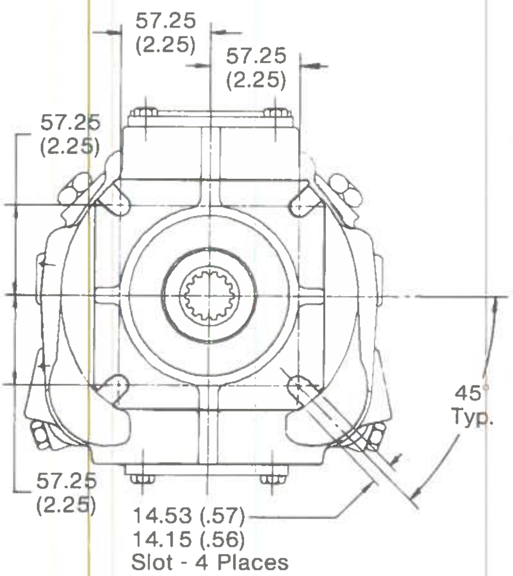
Application assistance

E Series piston pumps can be effectively used in POWER MATCH® high pressure hydraulic systems. To assure maximum unit performance in conjunction with your specific application, consult your Vickers representative.

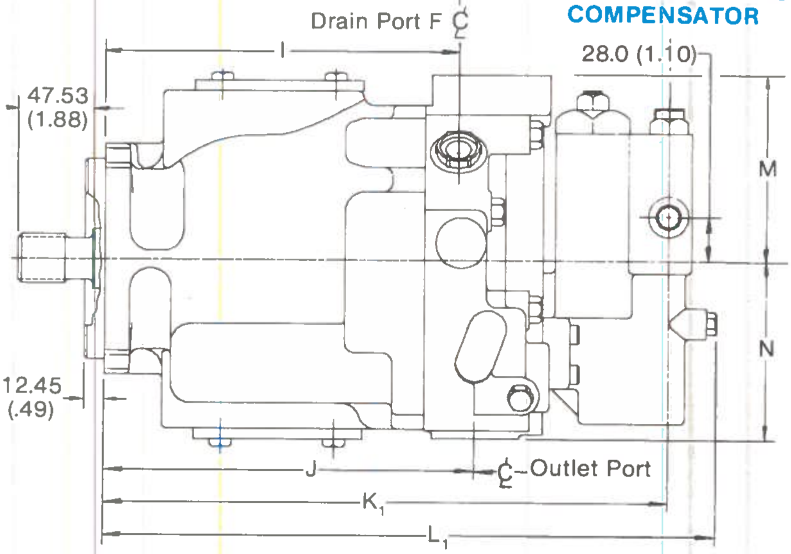
INSTALLATION DIMENSIONS — STANDARD VERSION

All Dimensions In Millimeters And (Inches)

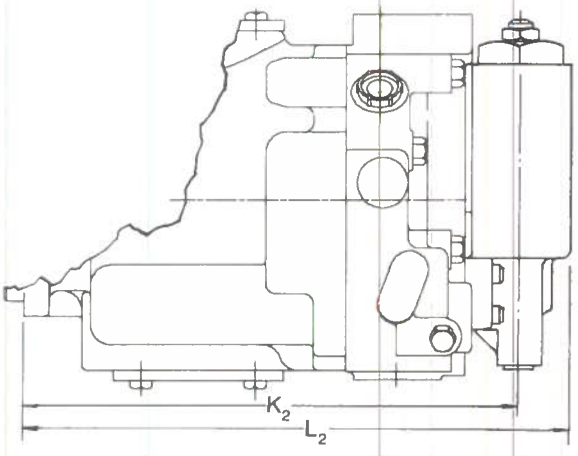




NOTE: All models have SAE "C" 4-Bolt Mounting Flange As Shown.



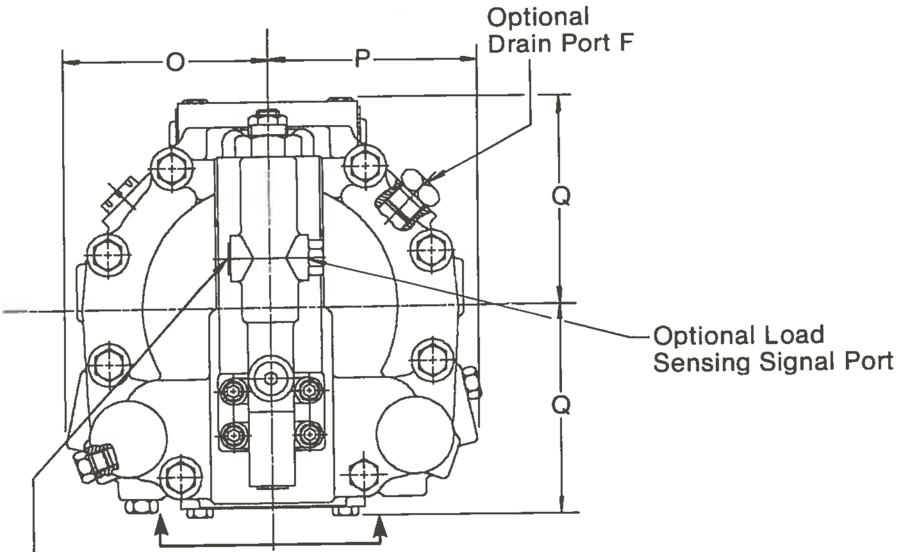
"CV" LOAD SENSING COMPENSATOR



"C" PRESSURE COMPENSATOR

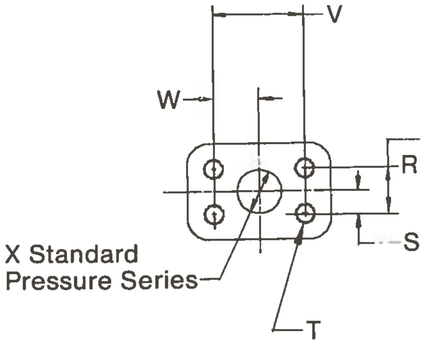
PUMP WEIGHTS

Model	Weight Kg	Weight Lbs.
PVE27	45	99
PVE35	58	115
PVE47	63	139
PVE62	77	170



View A-A

Load Sensing Signal Port
SAE "O" Ring Boss
.5625-18 UNF-2B Thd.



View A-A
Outlet Port

Model	A	B	C	D	E	F	G	H	I	J	K_1
PVE27	42.88 (1.69)	21.44 (.84)	50.80 (2.00)	38.88 (1.53)	77.76 (3.06)	.750 UNF-2B Thread	99.3 (3.91)	225.5 (8.88)	205.4 (8.09)	216.3 (8.52)	335.6 (13.21)
PVE35	42.88 (1.69)	21.44 (.84)	50.80 (2.00)	38.88 (1.53)	77.76 (3.06)	.750 UNF-2B Thread	110.0 (4.33)	243.6 (9.59)	224.0 (8.82)	235.0 (9.25)	357.2 (14.06)
PVE47	50.80 (2.00)	25.40 (1.00)	63.50 (2.50)	44.45 (1.75)	88.90 (3.50)	.875 UNF-2B Thread	111.6 (4.39)	266.2 (10.48)	240.2 (9.46)	251.2 (9.89)	378.3 (14.89)
PVE62	50.80 (2.00)	25.40 (1.00)	63.50 (2.50)	44.45 (1.75)	88.90 (3.50)	.875 UNF-2B Thread	113.3 (4.46)	274.5 (10.81)	252.5 (9.94)	262.3 (10.33)	390.6 (15.38)

Model	K_2	L_1	L_2	M	N	O	P	Q	R	S	T
PVE27	289.5 (11.40)	369.8 (14.56)	318.5 (12.54)	109.5 (4.31)	111.8 (4.40)	110.8 (4.36)	113.7 (4.48)	113.3 (4.46)	26.19 (1.03)	13.10 (.52)	M10 x 1.5 (.375-16)
PVE35	311.0 (12.24)	389.8 (15.35)	340.0 (13.39)	117.0 (4.61)	113.0 (4.45)	117.0 (4.61)	117.0 (4.61)	118.8 (4.68)	26.19 (1.03)	13.10 (.52)	M10 x 1.5 (.375-16)
PVE47	332.2 (13.08)	410.9 (16.18)	361.2 (14.22)	129.0 (5.08)	123.0 (4.84)	128.0 (5.04)	129.5 (5.10)	125.8 (4.95)	26.19 (1.03)	13.10 (.52)	M10 x 1.5 (.375-16)
PVE62	344.5 (13.56)	423.2 (16.66)	373.5 (14.70)	136.5 (5.37)	135.0 (5.31)	127.3 (5.01)	131.5 (5.18)	152.5 (6.00)	31.75 (1.25)	15.81 (.63)	M14 x 2.00 (.500-13)

Model	U	V	W	X
PVE27	M14 x 2.0 (.500-13)	52.37 (2.06)	26.19 (1.03)	25.40 (1.00)
PVE35	M14 x 2.0 (.500-13)	52.37 (2.06)	26.19 (1.03)	25.40 (1.00)
PVE47	M14 x 2.0 (.500-13)	52.37 (2.06)	26.19 (1.03)	25.40 (1.00)
PVE62	M14 x 2.0 (.500-13)	66.68 (2.63)	33.34 (1.31)	31.75 (1.25)

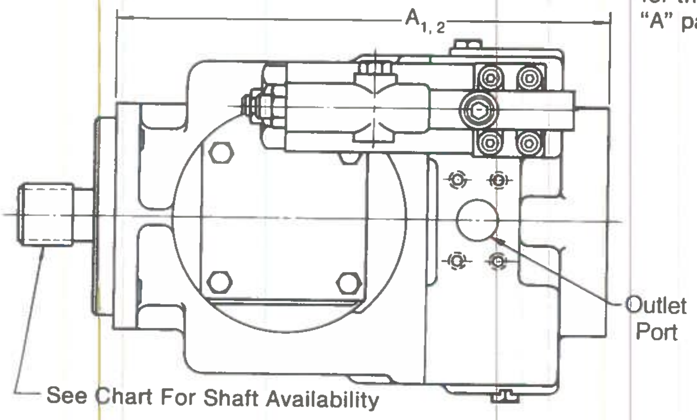
STANDARD SHAFT AVAILABILITY

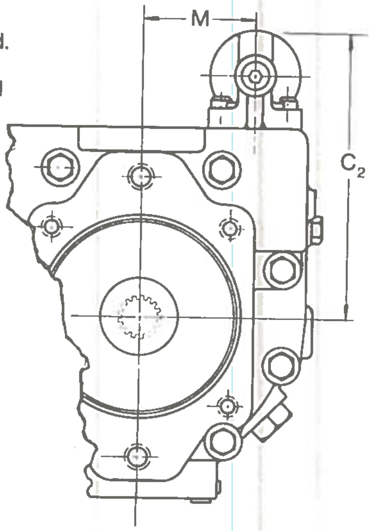
Pump Model	Shaft No.	Shaft Type	SAE Code
PVE27, 35, 47	1	Straight Key 31.75 (1.25) Dia.	C
	2	Spline 14T-12/24 D.P.	C
PVE62	3	Spline 17T-12/24 D.P.	C-C
	13	Straight Key 38.1 (1.50) Dia.	C-C

INSTALLATION DIMENSIONS — THRU-DRIVE VERSION

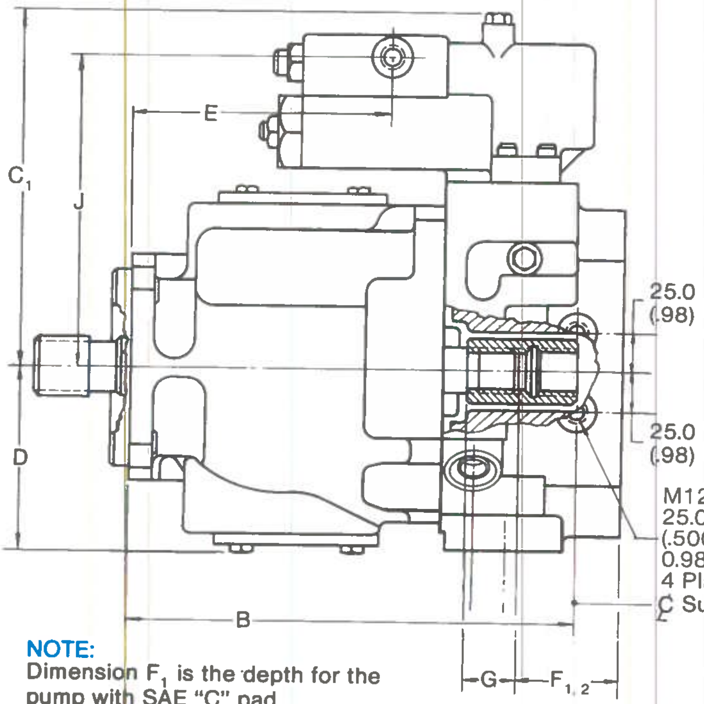
All Dimensions in Millimeters And (Inches)

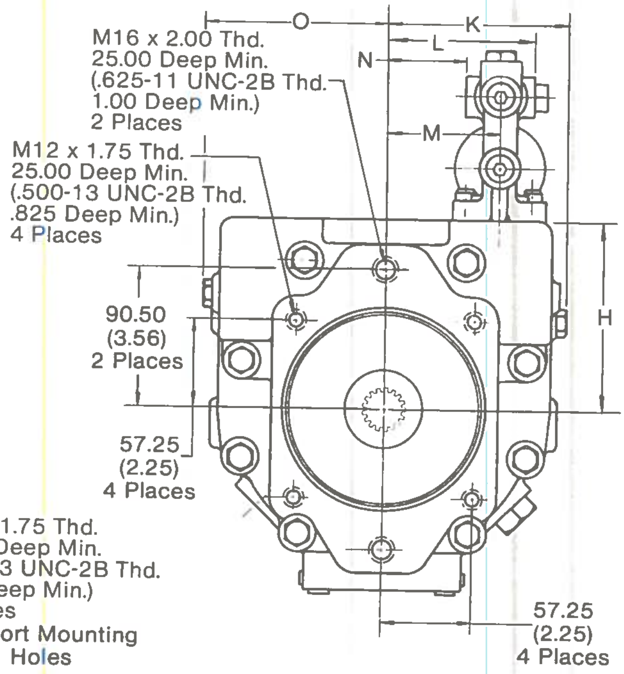
NOTE:
Dimension A_1 is overall length for the pump with SAE "C" pad. Dimension A_2 is overall length for the pump with SAE "B" and "A" pad.





"C" PRESSURE COMPENSATOR


C1
J
E
D
25.0 (.98)
25.0 (.98)
M12 x 1.75 Thd. 25.00 Deep Min. (.500-13 UNC-2B Thd. 0.98 Deep Min.) 4 Places
℄ Support Mounting Holes
B
G
F1, 2


O
K
L
N
M
M16 x 2.00 Thd. 25.00 Deep Min. (.625-11 UNC-2B Thd. 1.00 Deep Min.) 2 Places
M12 x 1.75 Thd. 25.00 Deep Min. (.500-13 UNC-2B Thd. .825 Deep Min.) 4 Places
90.50 (3.56) 2 Places
57.25 (2.25) 4 Places
H
57.25 (2.25) 4 Places

NOTE:
Dimension F_1 is the depth for the pump with SAE "C" pad.
Dimension F_2 is the depth for the pump with SAE "B" and "A" pad.

SAE "C" PAD
"CV" LOAD SENSING COMPENSATOR

Model	A_1	A_2	B	C_1	C_2	D	E	F_1	F_2	G	H
PVE27	301.3 (11.86)	295.3 (11.63)	272.3 (10.72)	234.7 (9.24)	185.0 (7.28)	113.3 (4.46)	150.3 (5.92)	61.9 (2.44)	55.9 (2.20)	36.4 (1.43)	123.0 (4.84)
PVE35	318.1 (12.52)	312.1 (12.29)	289.1 (11.38)	234.7 (9.24)	185.0 (7.28)	118.8 (4.68)	167.6 (6.60)	66.5 (2.62)	60.5 (2.38)	33.5 (1.32)	123.0 (4.84)
PVE47	334.2 (13.16)	328.2 (12.92)	305.2 (12.02)	247.7 (9.75)	198.0 (7.80)	125.8 (4.85)	183.2 (7.21)	64.5 (2.54)	58.5 (2.30)	32.8 (1.29)	136.0 (5.35)
PVE62	351.5 (13.84)	336.5 (13.25)	313.5 (12.34)	246.7 (9.71)	197.0 (7.76)	152.5 (6.00)	191.5 (7.54)	67.1 (2.64)	52.1 (2.05)	35.2 (1.39)	135.0 (5.31)

SOUND LEVELS

Vickers' new PVE pumps are designed to provide the highest levels of system performance with noise levels compatible with the stringent requirements of today's machinery. The standard models exhibit low sound levels across a wide variety of operating speeds and pressures to accommodate the conditions necessary for high performance mobile vehicles. In addition, quieted "Q" models have been developed that provide even lower sound levels at typical in-plant conditions.

Sound is generated by a variety of factors associated with the system, machine and environment. For more information concerning the causes and nature of noise in machinery, and methods to reduce sound levels, refer to Vickers "More Sound Advice" Bulletin 390.

STANDARD VERSION

Sound Level dB(a)
DIN (NFPA)*

Pressure	PVE 27		PVE 35		PVE 47		PVE 62	
Bar (psi)	1200 rpm	1500 rpm	1200 rpm	1500 rpm	1200 rpm	1500 rpm	1200 rpm	1500 rpm
70 (1015)	69 (71)	72 (75)	69 (71)	72 (74)	69 (72)	72 (75)	69 (72)	75 (78)
140 (2030)	72 (75)	73 (76)	76 (78)	78 (81)	73 (75)	74 (77)	76 (79)	78 (81)
210 (3045)	75 (77)	76 (78)	80 (82)	81 (83)	75 (77)	78 (81)	79 (81)	81 (84)
250 (3625)	76 (78)	77 (79)	81 (84)	82 (84)	77 (80)	81 (83)	80 (83)	83 (86)
QUIETED VERSION								
70 (1015)	66 (68)	69 (71)	64 (66)	68 (70)	69 (71)	70 (73)	69 (72)	75 (78)
140 (2030)	68 (70)	70 (72)	67 (69)	69 (72)	71 (74)	72 (84)	73 (75)	74 (77)
210 (3045)	69 (71)	73 (75)	71 (73)	72 (75)	74 (76)	74 (77)	77 (80)	77 (80)
250 (3625)	71 (73)	74 (76)	73 (75)	74 (76)	76 (78)	77 (79)	79 (81)	79 (82)

* DIN: Analytic semi-anechoic values per DIN 45635. NFPA: Recorded in a semi-anechoic chamber in accordance with NFPA Recommended Standard T3.9.70.12. All values shown are the higher of either full flow or fully compensated conditions.

CONTROLS

Vickers' PVE pumps are distinguished by a variety of highly responsive controls designed for maximum functional usefulness while minimizing energy consumption, heat generation and prime mover size. These controls respond effectively to match the pump output to the system requirements by controlling system pressure, pump flow or both. Controls may be selected to match circuit requirements and may result in fewer system components and/or longer component life.

Pressure Compensator Control (C or CM)

This control automatically varies pump displacement to provide, at a constant pressure, only that flow necessary to satisfy the load demand. Displacement starts to reduce at approximately 7 bar (100 psi) below the compensator setting. Control response is sufficiently fast to preclude the need for a pressure relief valve in most systems. The "C" control is adjustable from 70 bar (1015 psi) to 250 bar (3625 psi); the "CM" control is adjustable from 17 bar (250 psi) to 140 bar (2030 psi). (See Figure 1.)

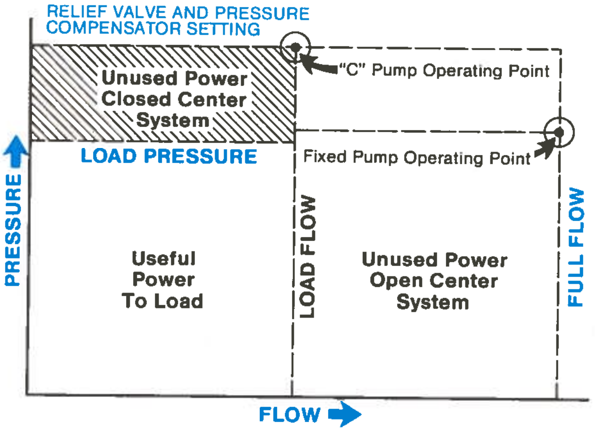
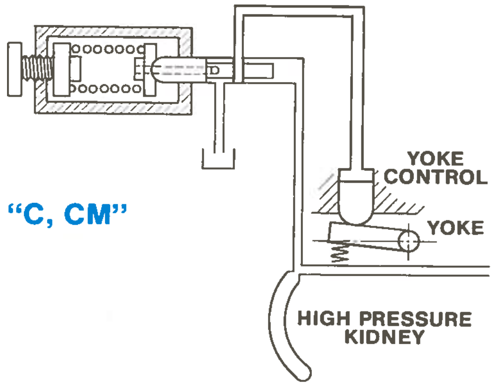
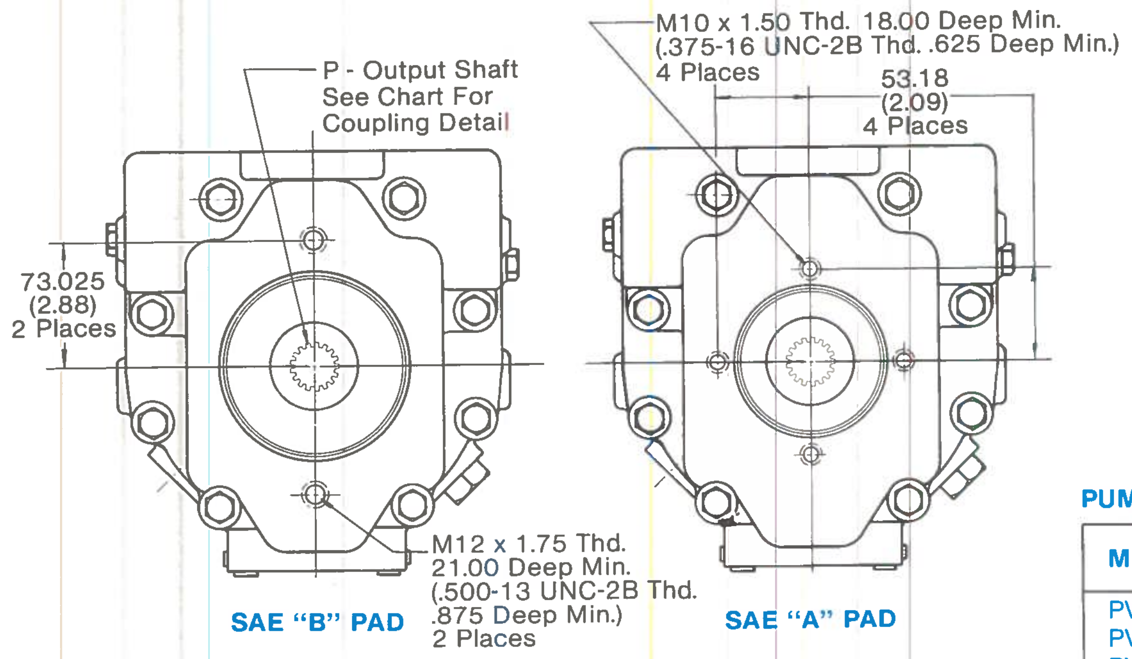


Fig. 1





PUMP WEIGHTS

Model	Weight	
	Kg	Lbs.
PVE27	58	128
PVE35	63	139
PVE47	72	163
PVE62	91	201

Thru-Drive Shaft Availability

Pump Model	Thru-Drive Pad	Shaft No.	Shaft Type	SAE Code
PVE27	A, B, C	1	Straight Key 31.75 (1.25) Dia.	C
		2	Spline 14T-12/24 D.P.	C
PVE35, 47	A	1	Straight Key 31.75 (1.25) Dia.	C
		2	Spline 14T-12/24 D.P.	C
	B, C	3	Spline 17T-12/24 D.P.	C-C
		13	Straight Key 38.1 (1.50) Dia.	C-C
PVE62	A	3	Spline 17T-12/24 D.P.	C-C
		13	Straight Key 38.1 (1.50) Dia.	C-C
	B, C	3	Spline 17T-12/24 D.P.	C-C
		16	Straight Key 127.0 (5.00) Dia.	D

COUPLING AVAILABILITY - must be ordered separately to drive second pump.

Pump Model	Output Pad (SAE)	Second Pump Shaft (SAE)	Coupling Part No.
PVE27	A	A	685430
	B	B	685429
		B-B	685428
	C	C	429368
PVE35	A	A	989141
	B	B	989153
		B-B	989167
	C	C	989154
		C-C	685537
PVE47, 62	A	A	430359
	B	B	430360
		B-B	429368
	C	C	429369
		C-C	682898

NOTE: Control is shown for counterclockwise rotation. For clockwise rotation control is located symetrically about ℄ of pump.

Model	J	K	L	M	N	O	P	
PVE27	202.1 (7.96)	118.3 (4.66)	94.5 (3.72)	72.5 (2.85)	50.5 (1.99)	118.3 (4.66)	15T-16/32 D.P.	For other dimensions not shown, refer to installation dimensions of the standard version.
PVE35	202.1 (7.96)	116.8 (4.60)	94.5 (3.72)	72.5 (2.85)	50.5 (1.99)	116.8 (4.60)	17T-16/32 D.P.	
PVE47	215.1 (8.47)	129.5 (5.10)	105.2 (4.14)	83.2 (3.28)	61.2 (2.41)	129.5 (5.10)	14T-12/24 D.P.	
PVE62	214.1 (8.43)	136.3 (5.37)	111.8 (4.40)	89.8 (3.54)	67.8 (2.67)	136.3 (5.37)	14T-12/24 D.P.	

Load Sensing and Pressure Limiting Control (CV)

This control provides a power match between the pump and the load, thereby maximizing system efficiency and improving the metering characteristics of the system directional valve. In addition, it provides an economical, energy-conserving stand-by mode when there is no load on the system. The control senses pump outlet pressure and load pressure, and maintains a constant difference between the two. The differential pressure is applied across a metering land in the system directional valve, with the result that the pump flow becomes a function of the valve spool position, independent of load pressure.

The load pressure signal is generated downstream of the control valve metering land and is communicated to the pump load sensor by a signal line. In a multiple-spool load-sensing valve, the highest pressure level in use must be communicated to the pump control. In addition, the pump displacement is cut off if load pressure reaches the setting of the pressure limiter. (See Figure 2.)

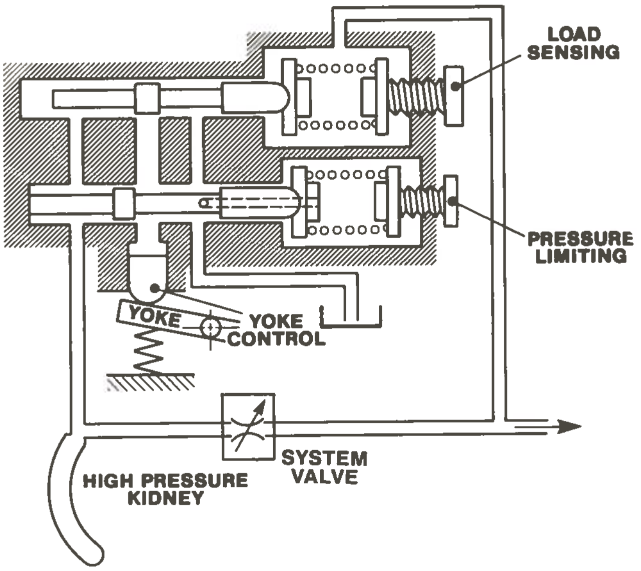


Fig. 2 "CV"

Load-Sensing Control with Torque and Pressure Limiter (CVT)

This control incorporates the features and performs the functions of the load-sensing pressure-limiting "CV" control, and pressure- and torque-limiting "CT". Load-sensing and torque-limiting functions are performed independently. However, when the input torque setting is reached, the torque limiter overrides the load sensor. (See Figure 3.)

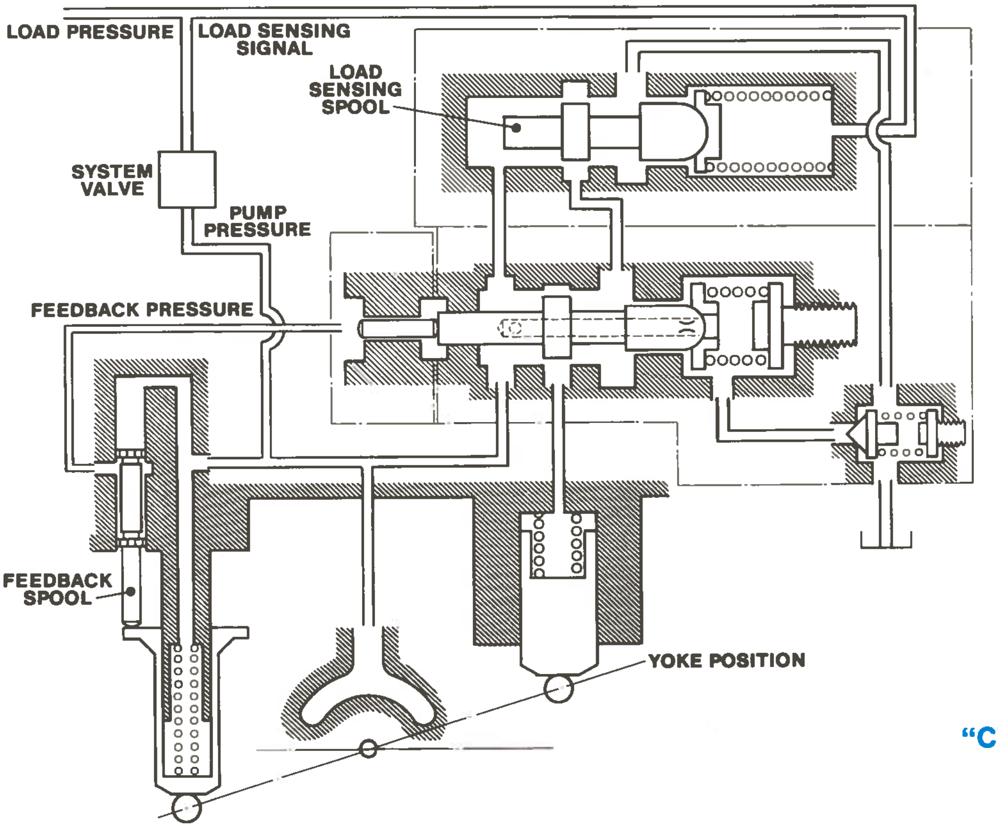


Fig. 3 "CVT"

Pressure and Torque Limiter Control (CT)

This control allows maximum performance to be obtained from the prime mover. It limits pump input torque to a preset value while the pressure compensator limits maximum pressure in the system.

When pump input speed remains constant, the torque limiter acts as an input horsepower limiter. At low load levels the control permits high pump displacement, and thus high load speeds. With heavy loads, the load speed is reduced and stalling of the prime mover is prevented. (See Figure 4.)

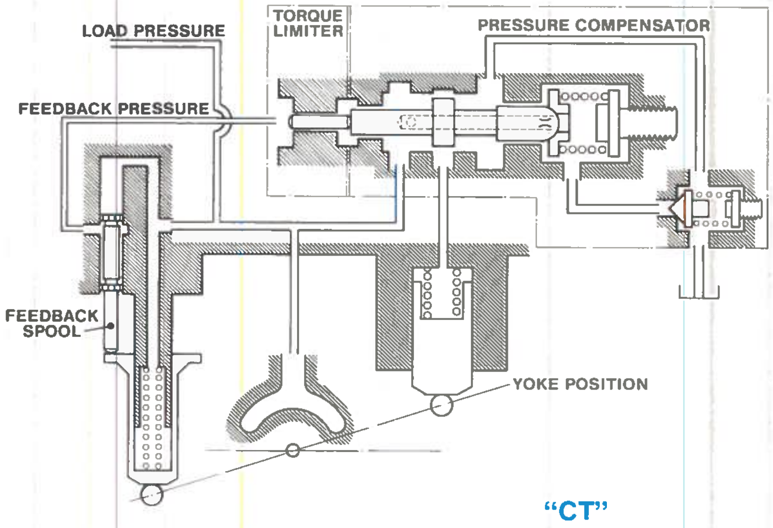


Fig. 4

Torque Summation and Pressure Limiter Control (CTS)

On applications where a single power source is driving two pumps, this control assures that pump demands do not exceed available input torque. The control allows full power from the prime mover to be absorbed by either pump, but limits the sum of the pump input torques to a level which will prevent stalling of the prime mover. (See Figure 5.) This control also incorporates the features and performs the functions of the pressure-limiting "C" control.

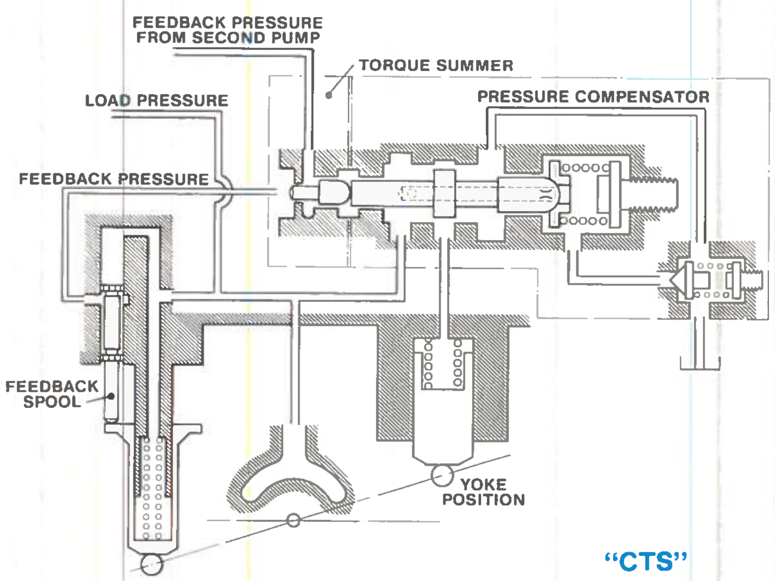


Fig. 5

MODEL CODE

PVE	35	QI	L	–	A	2	M	D	–	22	–	C	25	VT	18	–	13
1	2	3	4		5	6	7	8		9		10	11	10	12		13

1 Model Series

2 Flow Rating @ 1800 RPM 100 psi (7 Bar)

27 - 27 GPM (102 l/min). 3.5 CIR (57.4 cc/R)
35 - 35 GPM (132 l/min), 4.5 CIR (73.7 cc/R)
47 - 47 GPM (178 l/min), 6.0 CIR (98.3 cc/R)
62 - 62 GPM (235 l/min), 8.0 CIR (131.1 cc/R)

3 Quiet Option

Blank - Standard
QI - Quieted Version

4 Shaft Rotation (viewed from shaft end)

R - Right Hand Rotation (clockwise)
L - Left Hand Rotation (counterclockwise)

5 Thru-Drive, Ports and Configuration

Blank - Side Ports, Rear Mounted Control (standard)
A - Side Ports with "A" Pad Auxiliary Mounting, Side Mounted Controls
B - Side Ports with "B" Pad Auxiliary Mounting, Side Mounted Controls
C - Side Ports with "C" Pad Auxiliary Mounting, Side Mounted Controls
H - Side Ports and Side Mounted Control

6 Input Shaft

1 - Straight Keyed, 1¼" Dia. "C" per SAE 744c
2 - Splined, 14T-12/24 D.P. "C" per SAE 744c
3 - Splined, 17T-12/24 D.P. "CC" per SAE 744c
13 - Straight Keyed, 1½" Dia. "CC" per SAE 744c
16 - Straight Keyed, 1¾" Dia. "D" per SAE 744c

Note: See tables under installation dimensions for available pump/shaft configurations.

Note: SAE "C" 2-bolt pad is not available on the PVE 62 model when torque controls (CT, CVT, CTS) are specified.

7 Port Designation

Blank - 4-Bolt Flange per SAE I-518
M - 4-Bolt Flange per ISO/DIS 6162

8 Shaft Seal

Blank - Single (standard)
D - Double (For "wet mount" applications)
N - None

9 Pump Design Number

21 - PVE62
22 - PVE27/35/47

10 Control Option

C - Pressure Compensator, 70-250 Bar (1015-3625 PSI)
CM - Pressure Compensator, 17-138 Bar (250-2000 PSI)
CV - Load Sensing with Pressure Limiter
CT - Torque and Pressure Limiter
CVT - Load Sensing with Torque and Pressure Limiter
CTS - Torque Summation and Pressure Limiter

11 Pressure Compensator Setting-Tens of Bars

25 - (C standard) 250 Bar (3625 PSI)
7 - (CM standard) 70 Bar (1015 PSI)

12 Torque Control Options Pressure Setting-Tens of Bars

18 - (T standard) 180 Bar (2610 PSI)

13 Control Design Number

13 - CT, CTS
14 - CVT
21 - C, CM, CV

VICKERS

A TRINOVA COMPANY

Vickers, Incorporated
1401 Crooks Road – Troy, Michigan 48084
For the location of our nearest distributor or district office, dial toll-free 1-800-243-8160.

396–I87D

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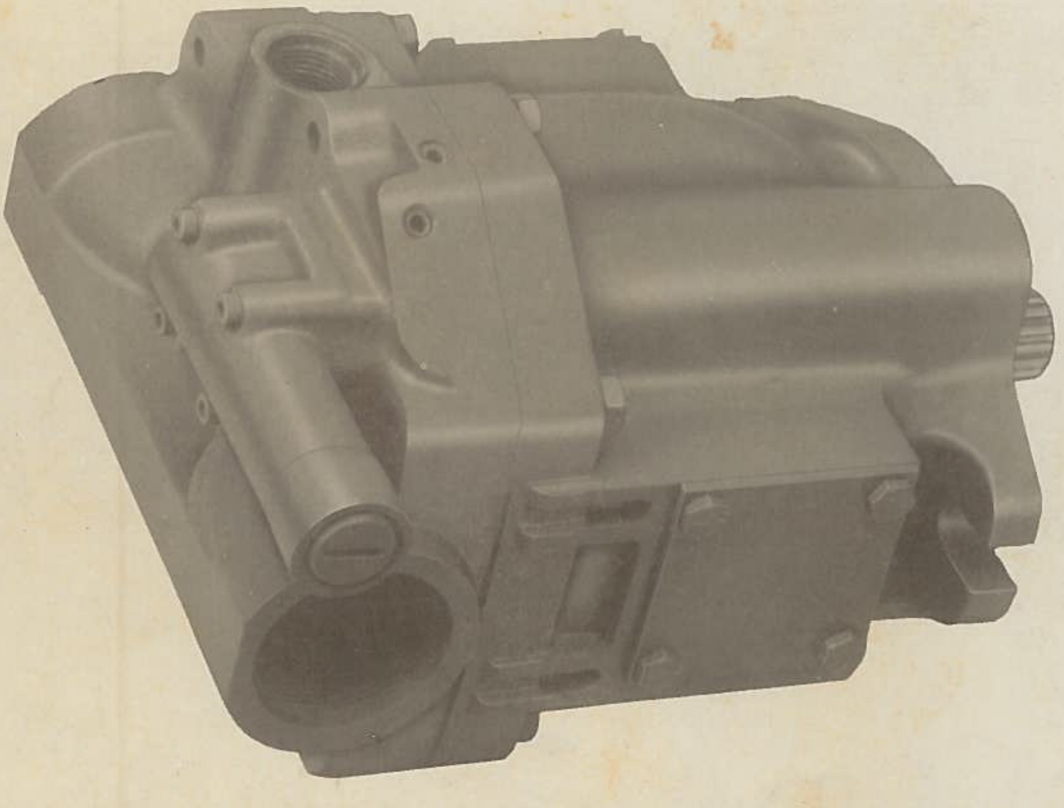
Service Parts Information

Variable Displacement Piston Pumps With Pressure Compensator

PVE19/21-**-*-20-C***-1*
PVE19/21-**-*-30-C***-1*

30



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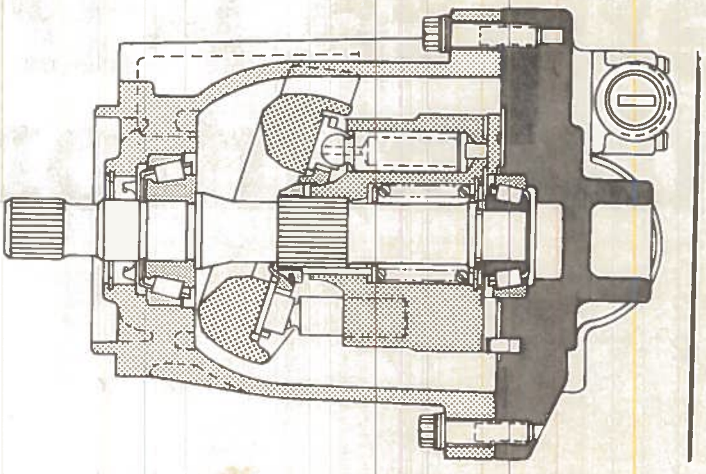
M-2841-S

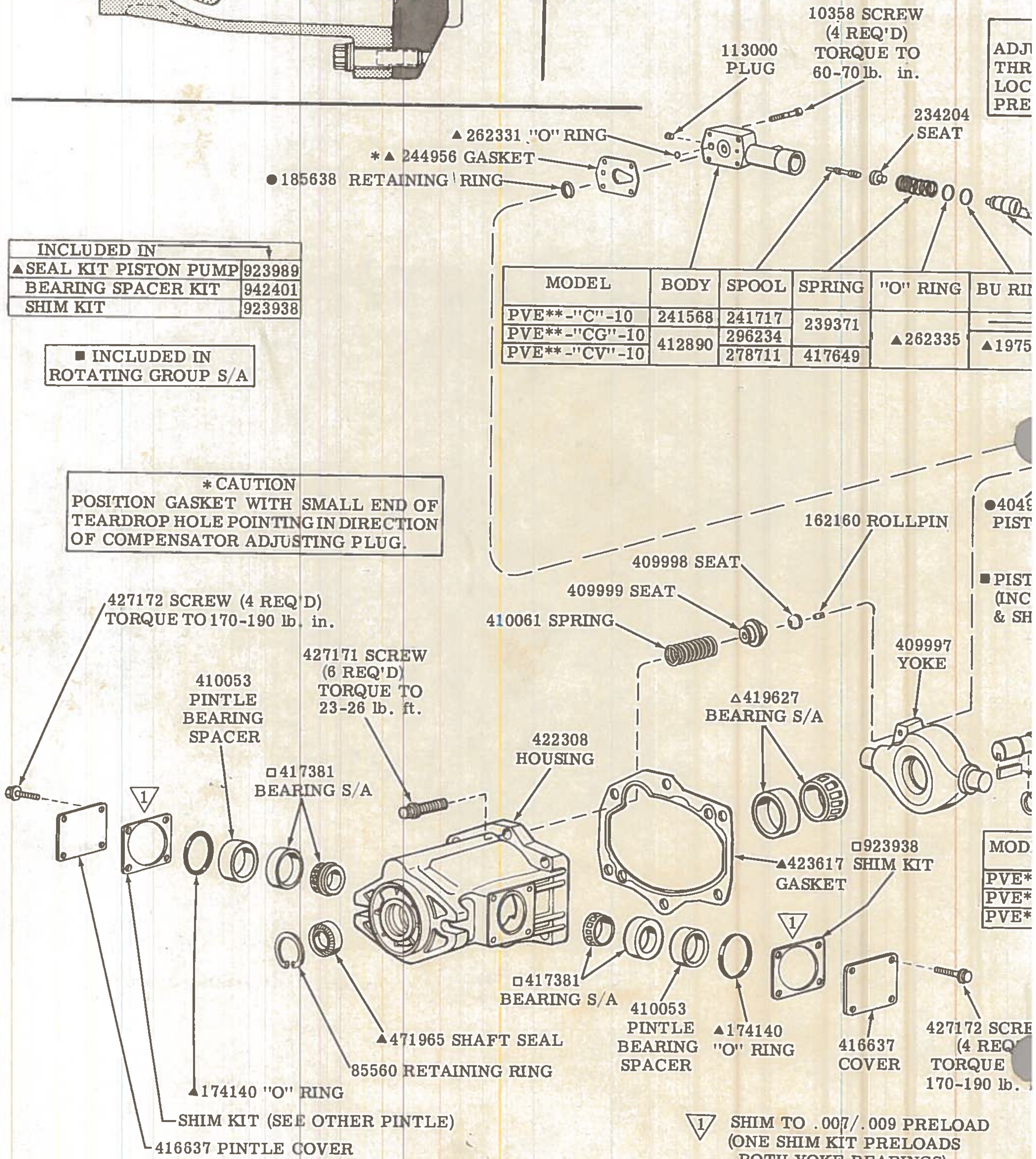


NOTE
THE "CVP" COMPENSATOR
AS A COMPLETE FACTORY
ORDERING PART NUMBER SI
BELOW.

C,CG & CV COMPENSATOI

(SHOWN FOR RIGHT HAND SHAFT ROTA
ROTATE 180° FOR LEFT HAND SHAFT R

ADJU
THR
LOC
PRE



MODEL	BODY	SPOOL	SPRING	"O" RING	BU RI
PVE**-"C"-10	241568	241717	239371	▲262335	—
PVE**-"CG"-10	412890	296234			▲1975
PVE**-"CV"-10		278711	417649		

INCLUDED IN	
▲SEAL KIT PISTON PUMP	923989
BEARING SPACER KIT	942401
SHIM KIT	923938

■ INCLUDED IN
ROTATING GROUP S/A

*CAUTION
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJUSTING PLUG.

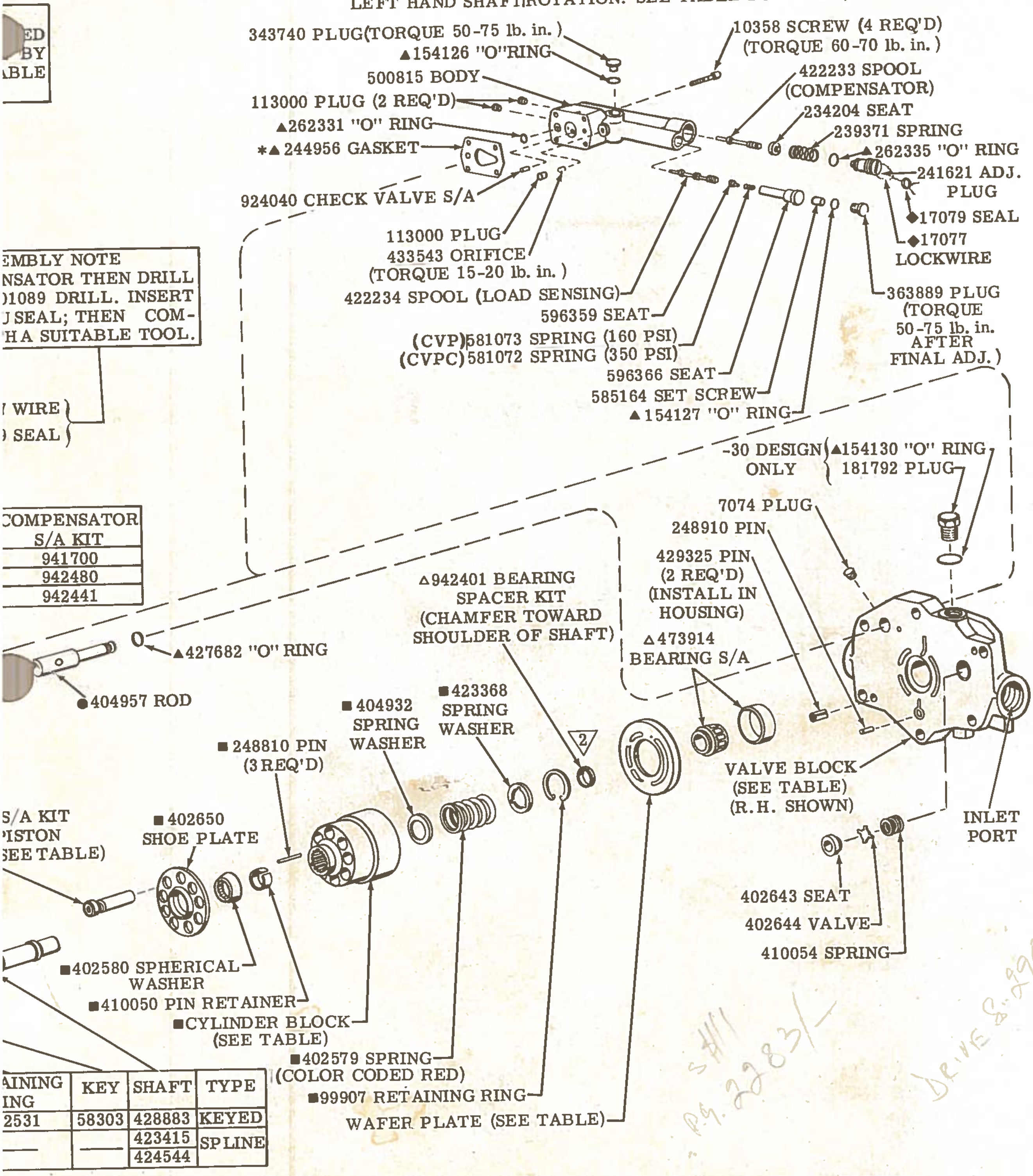
MOD
PVE*
PVE*
PVE*

1 SHIM TO .007/.009 PRELOAD (ONE SHIM KIT PRELOADS BOTH YOKE BEARINGS)

2 SELECT SPACER TO PROVIDE .001/.003 PRELOAD.

CVP(C) COMPENSATOR

SHOWN FOR RIGHT HAND SHAFT ROTATION, ROTATE 180° FOR LEFT HAND SHAFT ROTATION. SEE TABLE FOR CVP S/A PART NUMBERS.



COMPENSATOR S/A KIT
941700
942480
942441

AINING ING	KEY	SHAFT	TYPE
2531	58303	428883	KEYED
——	——	423415 424544	SPLINE

s/11
Pg. 2283/-

Drive 8:-990/-#

17/31

750/- #

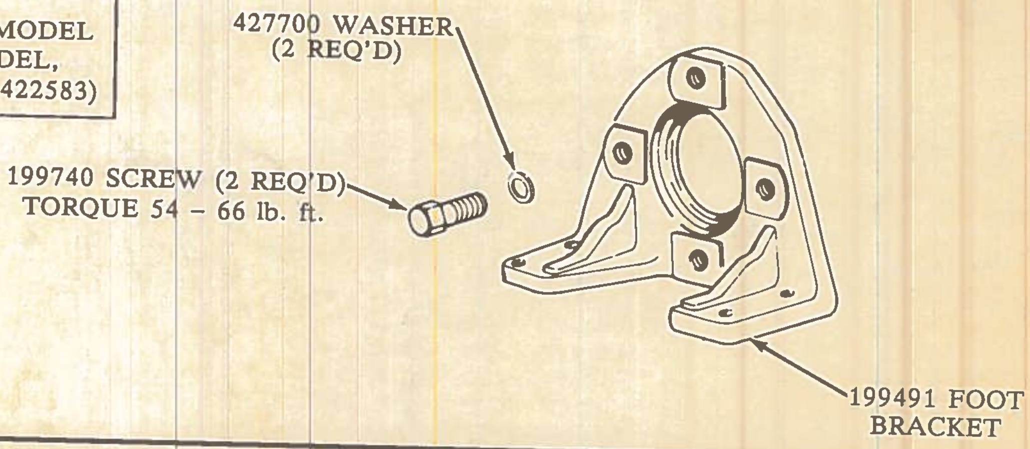
MODEL	ROTATION VIEWED FROM SHAFT END	-20 VALVE BLOCK	-30 VALVE BLOCK	-12 CVP(C) COMP. S/A	WAFER PLATE	■CYL. BLOCK	PISTON SHOE S/A:■INCL. 9 PISTON SHOE S/A	■ROT. GROUP
PVE19-R	C/WISE	423337	429729	924061	425412	426454	923939	923948
PVE19-L	CC/WISE	423329	435281		425415			
PVE21-R	C/WISE	423337	429729	924062	425413	418215	923946	923947
PVE21-L	CC/WISE	423329	435281		425416			

●INCLUDED IN 923960 COMPENSATOR PISTON & ROD S/A KIT.

□INCLUDED IN 923987 YOKE BEARING KIT

△INCLUDED IN 923988 SHAFT BEARING KIT

NOTE
TO CONVERT FLANGE MODEL
TO FOOT BRACKET MODEL,
ORDER FB-B-10 (ASS'Y 422583)



MODEL CODE BREAKDOWN

`PVE**(*)*–*–**–C***–1*`

PUMP

VARIABLE
DISPLACEMENT

E – SERIES INLINE
PISTON UNIT

FLOW RATING
@1800 RPM
19 – 19 USGPM
21 – 21 USGPM

F – FOOT MOUNTING
(OMIT FOR FLANGE)

SHAFT ROTATION
(VIEWED FROM SHAFT END)
R – RIGHT HAND
(CLOCKWISE)
L – LEFT HAND
(C'CLOCKWISE)

INPUT SHAFT
1 – SAE B-B STRAIGHT THREAD
2 – SAE B-B 15 TOOTH SPLINE
9 – SAE B 13 TOOTH SPLINE

PUMP DESIGN
–20 SINGLE DRAIN PORT
–30 DUAL DRAIN PORT

CONTROL TYPE & DESIGN
C–10 PRESSURE COMPENSATED
(PVE19, 250 – 3000 PSI)
(PVE21, 250 – 2700 PSI)
CG–10 REMOTE CONTROL PRESSURE COMPENSATOR ADJUSTABLE FROM 350 – 3000 PSI USING AN EXTERNAL RELIEF VALVE
CV–10 LOAD SENSING PVE19/21
CVP–12 LOAD SENSING (160 PSID) WITH PRESSURE COMPENSATION (PVE21 ONLY)
CVPC–12 LOAD SENSING (350 PSID) WITH PRESSURE COMPENSATION (PVE21 ONLY)

To insure sustained efficiency and maximum trouble free life of this precision equipment, initial and continuous full flow filtration of the fluid medium is essential. Select and apply filters from the Vickers OFP, OFR, and OFRS series, which are available in 3, 10, and 25 micrometre filtration ratings.

Litho in U.S.A.

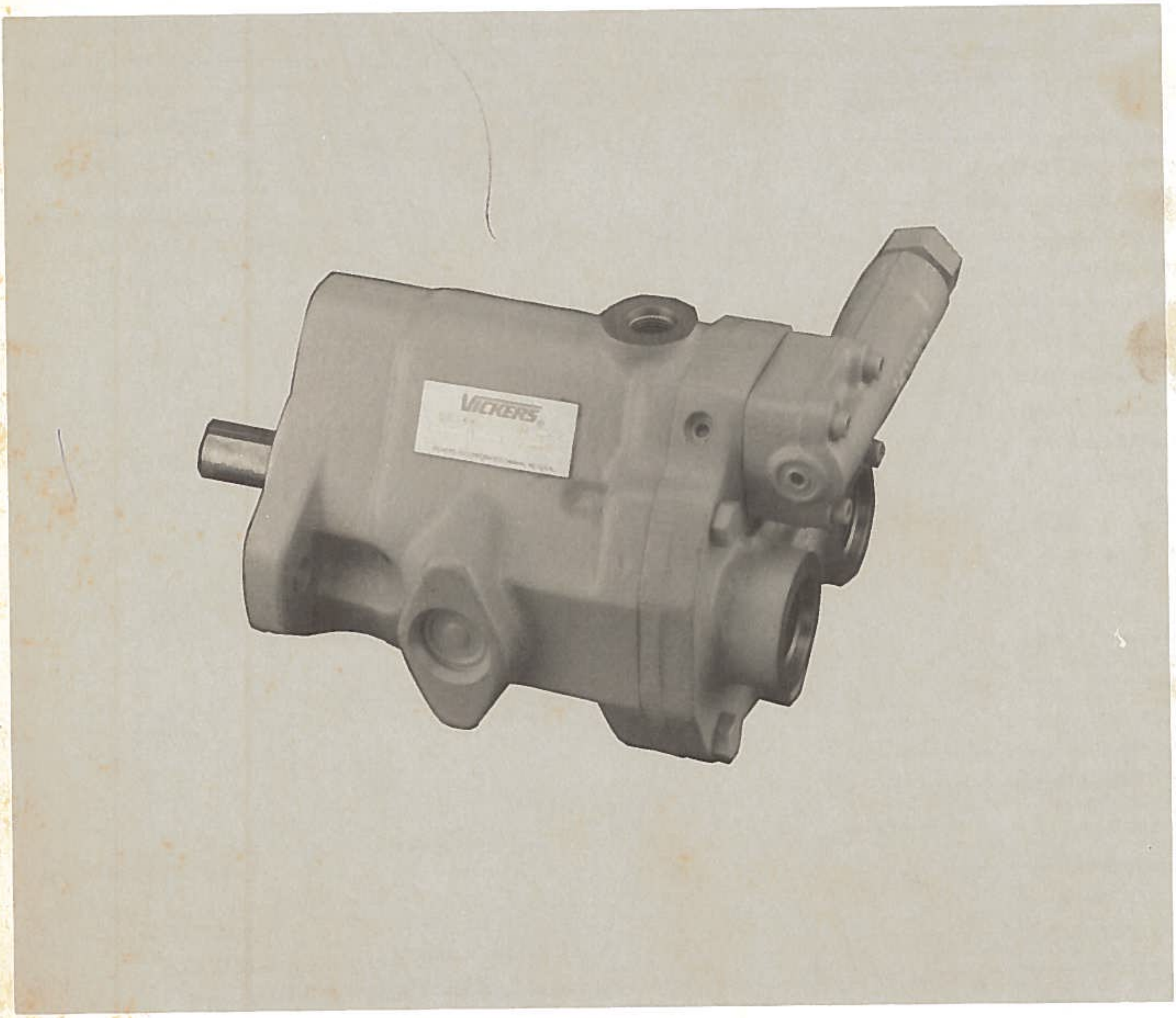
Service Data

VICKERS

Low Noise Industrial Piston Pump

32

PVQ 10–A2/MA * *** – ** * * – 10 C** *** *** * – 11/12/20
PVQ 13–A2/MA * *** – ** * * – 10 C** *** *** * – 11/12/20



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5445 Corporate Drive
P. O. Box 302
Troy, Michigan 48007-0302
U.S.A.

Released 09-01-91

CAUTION

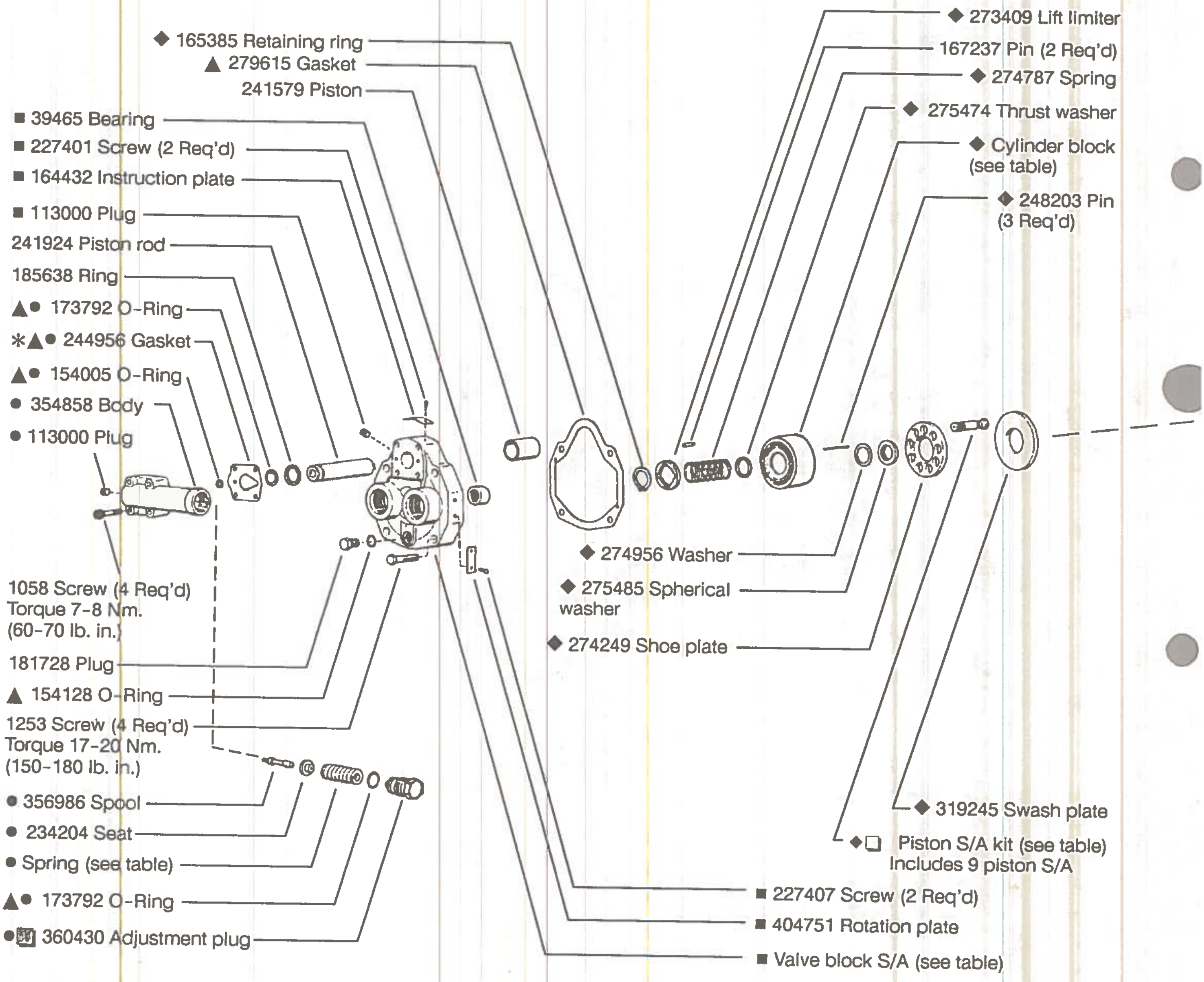
Model PVQ13C compensator pressure adjustment shall not exceed 2000 psi

NOTE:

C, CM Compensator shown for right hand rotation. Rotate 180° for left hand shaft rotation and connect to left hand valve block S/A.

Model	● Comp. kit	● Comp. Spring	● Load Sense Spring
PVQ**C	942158	239371	———
PVQ**CM	942159	265693	———
PVQ**CG	942480	239371	———
PVQ**FCG	941353	265693	———
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

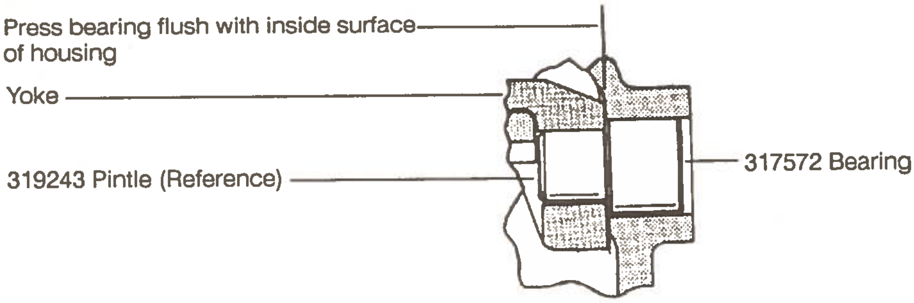
9 NOTE: See model code for pressure range settings of individual compensator kits.



*** CAUTION**

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

■ Valve block S/A	Right hand	Left hand
Rear ports	860757	860756
Side ports	860759	860758

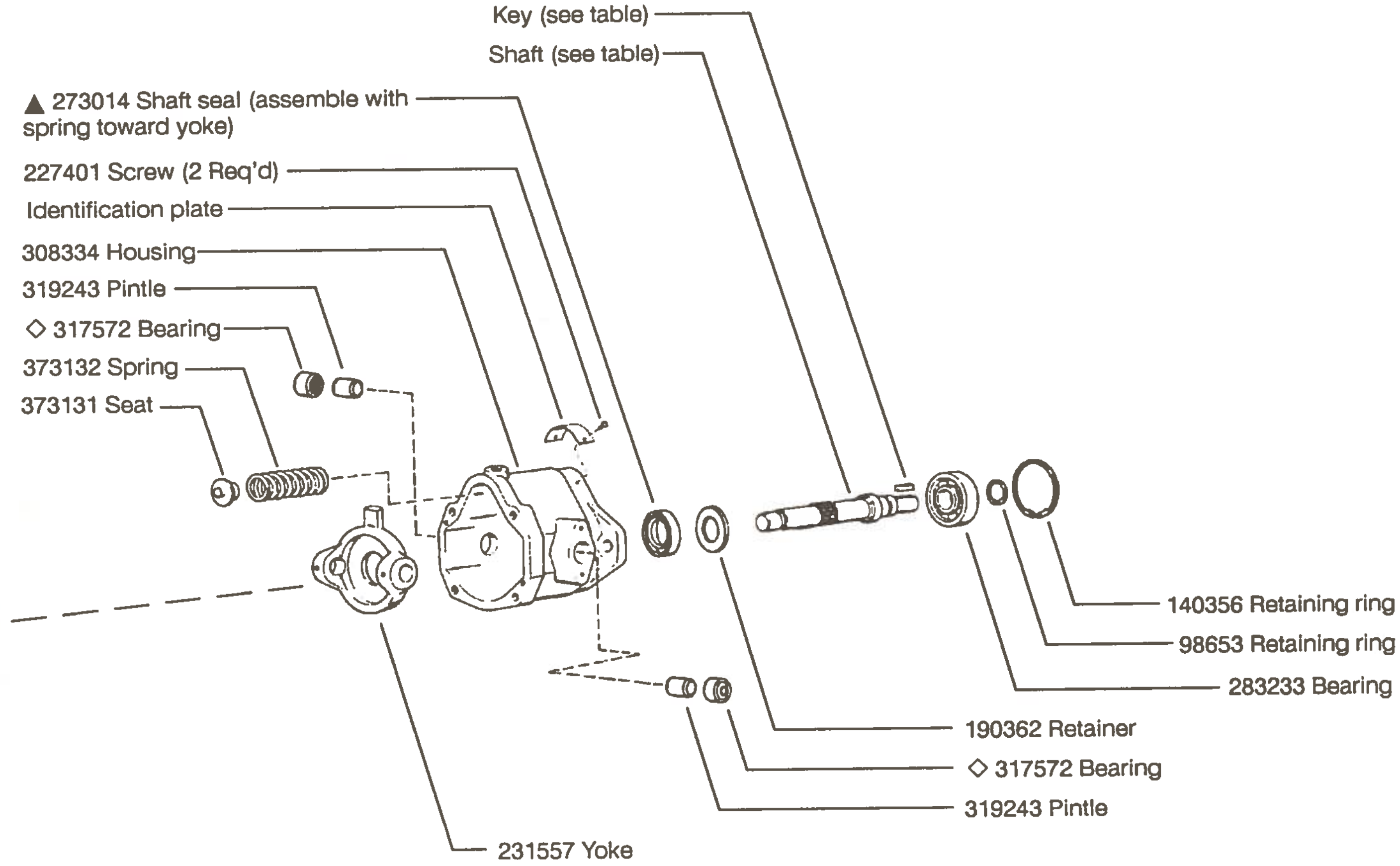

Press bearing flush with inside surface of housing
Yoke
319243 Pintle (Reference)
317572 Bearing

◇ PINTLE BEARING ASSEMBLY NOTE

The bearing O.D. surface and mating surface in the housing must be clean. Apply sealing compound (Loctite A (10-1) or equivalent) to the bearing O.D. and press in place.

CAUTION

Do not allow sealing compound to contact the bearing needles.



Model	Cylinder block	☐ Piston S/A kit	◆ Rotating group kit
PVQ10	274670	942229	938262
PVQ13	315148	942230	938264

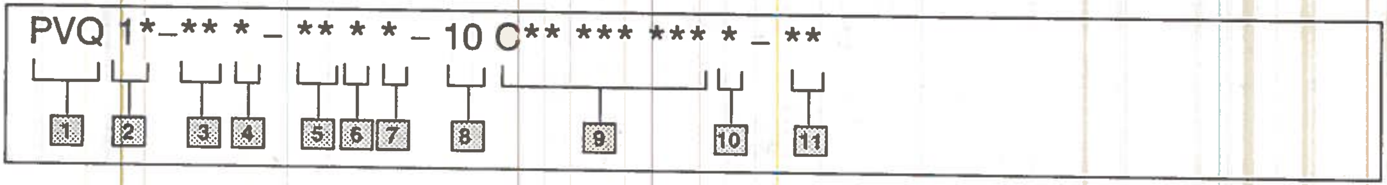
Shaft	Type	Key
266162	1	142843
286848	3	—
883030	N	472255

NOTE:
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

▲ Standard seal kit 919191
F3 equivalent seal kit 919308
● Compensator kit (see table)
■ Valve block S/A (see table)
◆ Rotating group kit (see table)
☐ Piston S/A kit (see table)

Model Code

PVQ 1*–** * – ** * * – 10 C** *** *** * – **



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement

(CC/Rev & Pressure ratings)

10 – 10 CC/Rev (.64 CIR)
210 bar (3000 psi)
13 – 13 CC/Rev (.84 CIR)
140 bar (2000 psi)

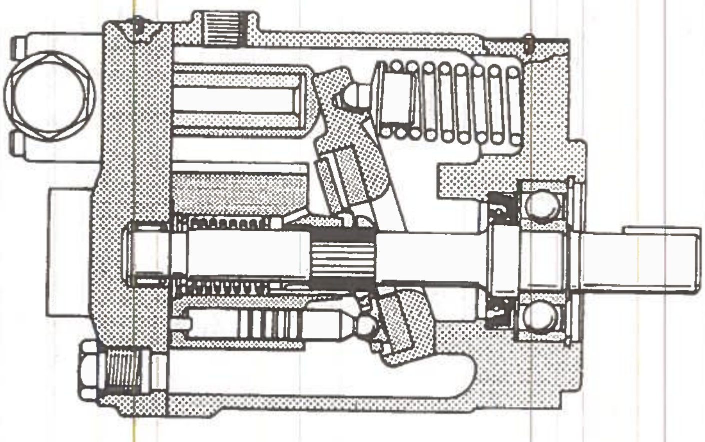
3 Mounting flange

A2 – SAE "A" 2-bolt
MA – ISO 3019/2 "A" 2-bolt (available with "N" driveshaft only)

4 Rotation

(viewed from shaft end)

R – Right hand (CW), (standard)
L – Left hand (CCW), (optional)



Typical sectional view

5 Ports

(type and location)

SE – O-Ring boss rear port, 1.0625 inch (Inlet & Outlet) (standard)
SS – O-Ring boss side port, 1.3125 inch (Inlet & Outlet) (optional)

6 Shafts

(Input)

1 – Straight keyed SAE "A" modified .75 inch Dia. x 1.75 inch long
3 – Splined SAE "A" modified 9T, 16/32 DP major Dia. fit
N – ISO 3019/2 short straight keyed (available with "MA" mounting only)

7 Seals

S – Buna N (standard)
F – Fluorocarbon, (optional)

8 Pump design number

10 – First design

9 Control type

C** – Pressure compensator, PVQ10: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ13: Std. model is C14 indicating factory setting of 140 bar (2000 psi). Range is 02-14 in tens of bar (350-2000 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
CV**B** – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice. Example: C21V11B indicates PVQ10 compensator with 210 bar pressure setting and 11 bar load sense differential.
CV**P** – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
CVC**B** – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
CVC**P** – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD** – Electric dual range compensator. PVQ10: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ13: Std. model is CD1407, indicating settings of 140 and 70 bar, adjustment ranges are 20-140 bar (high) and 20-100 bar (low).

10 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

11 Control design

11 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

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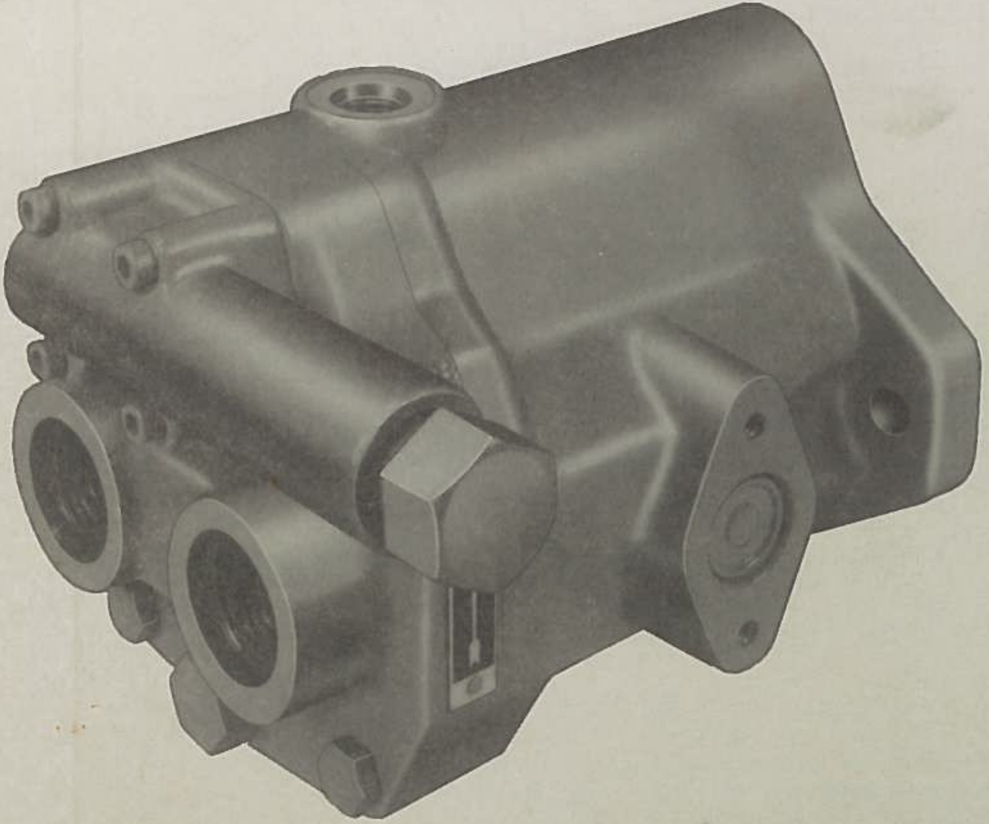
Overhaul Manual

Fixed & Variable Displacement Inline Piston Pumps & Motors

MFB Series
MVB Series
P(M)FB Series
P(M)VB Series

5



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Revised 7-1-86

I-3230-S

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Section I · INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes operational characteristics and overhaul information for the fixed and variable delivery inline piston type pumps and motors. The information contained herein pertains to the latest design series.

B. GENERAL INFORMATION

1. Related Publications - Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 1 are available any Vickers sales representative or from:

Vickers, Incorporated
Technical Publications
1401 Crooks Road
Troy, Michigan 48084

2. Model Codes - Variations within each basic model series are covered in the model code. Table 2 is a complete breakdown of the codes covering these units. Service inquiries should always include the complete unit model code number as stamped on nameplate located on housing.

MODEL	INSTALLATION DRAWING	PARTS DRAWING
M-MFB5	289420	I-3238-S
MFB5	520300	I-3238-S
MFB10	000324	I-3244-S
M-MFB15	000324	M-2765-S
M-MFB20	289420	M-2763-S
MFB20	000324	I-3247-S
M-MFB29	000324	M-2763-S
MFB29	520310	I-3741-S
MVB5	273831	I-3280-S
MVB10	273838	I-3268-S
M-MVB29	000324	M-2773-S
M-PFB5	289424	I-3238-S
PFB5	507725	I-3238-S
M-PFB10	289419	M-2202-S
PFB10	507727	I-3244-S
M-PFB15	289419	M-2202-S
M-PFB20	289426	M-2203-S
PFB20	507729	I-3247-S
M-PFB29	289426	M-2203-S
PVB5	508300	I-3280-S
PVB6	508300	I-3280-S
PVB6A	508275	I-3281-S
M-PVB10	289419	M-2212-S
PVB10	508400	I-3268-S
M-PVB15	000324	M-2212-S
PVB15	508400	I-3268-S
M-PVB20	000324	M-2213-S
PVB20	508500	I-3267-S
M-PVB29	000324	M-2213-S
PVB29	508500	I-3267-S
PVB45A	508890	I-3294-S

Table 1. Reference Material

MODEL CODE BREAKDOWN

(F3)—(M)—* * B **—(F) * * (F) * (Y)— * * (*) (L)—**—*****

F3 - Mineral Oil and Fire Resistant Fluids
F6 - High Water Base Fluids

Mobile Application (Omit for industrial applications)

M - Motor
P - Pump

F - Fixed
V - Variable

In-Line Piston Series

USGPM Rating @ 1800 RPM
5 - 5 USGPM
6 - 6 USGPM
10 - 10 USGPM
15 - 15 USGPM
20 - 20 USGPM
29 - 29 USGPM
45A - 45 USGPM

F - Foot Mounting
Omit for Flange Mounting

Rotation (Viewed from shaft end)
R - Right Hand
L - Left Hand
U - Either Direction (motors only)

Displacement
S - One Side of Center (pressure compensator models)
D - Both Sides of Center (handwheel & lever models)

Port Connections
F - Flanged Ports (on "W" & "X" optional features only)
Omit for Standard Shaft & Threaded Connections at Rear

Optional Ports and Shaft
W - Side Ports (flanged - standard shaft)
X - Through Shaft - Side Ports (flanged) "C" & "CM" controls only

Drive Shaft
Y - Standard Shaft (keyed)
Omit for Short Shaft
G - Spline Shaft (mobile)

Pump or Motor Design Number

Control Type
C - Pressure Compensator (250-3000 PSI)
CM - Pressure Compensator (250-1500 PSI)
D - Stem Servo Control
H - Handwheel
M - Lever
V - No Control

Control Option
C - Adjustable Maximum Displacement Stop (with compensator) (not available with thru shaft models)

Compensator Variations
D - Dual Range (electric control) (not available with thru shaft)
E - Start-Up Valve
G - Remote Compensator (use CCG for L.H. side port models)

Other Controls or Options
L - Left Hand Location Viewing Shaft End (handwheel & lever only)

Control Design Number

Special Features

Table 2. Model Code Breakdown

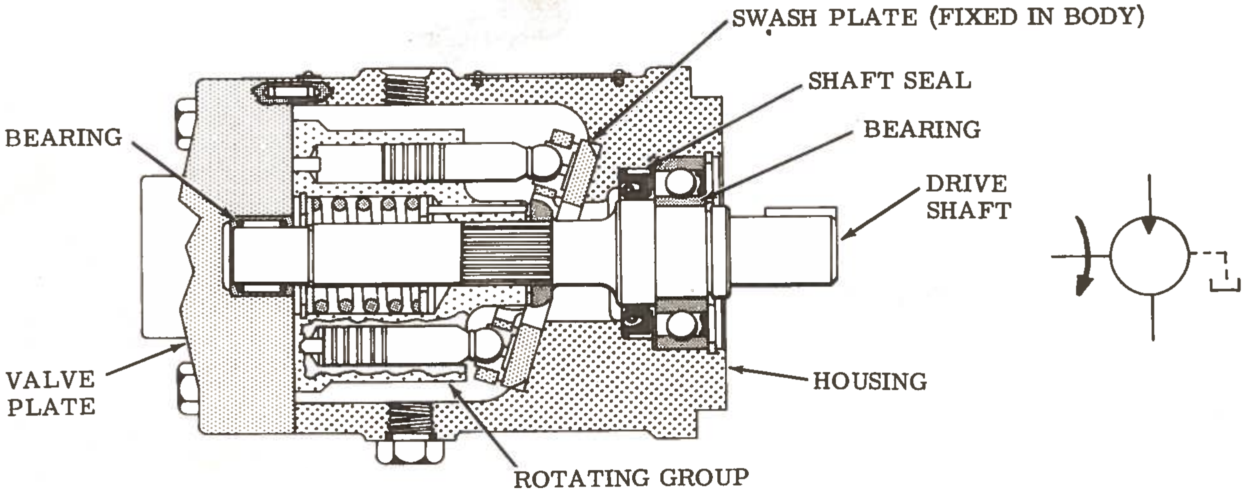
A. GENERAL

Vickers inline pumps and motors are of the axial piston, positive displacement type and include both fixed and adjustable (variable) displacement pumps and motors capable of high pressure operation. Drive speeds vary with the model, type of fluid used, and circuit application.

B. ASSEMBLY AND CONSTRUCTION

The assembly of typical fixed and variable displacement units together with their A.N.S.I. symbols are shown in Figure 1. As illustrated, the major components of the inline unit are the housing, bearing-supported drive shaft, rotating group, swash plate and valve plate. The pressure compensated variable displacement units incorporate a pressure sensitive control piston, which governs the angle of the yoke and swash plate and consequently controls the stroke length of each piston as it rotates with the cylinder block and drive shaft. The valve plate subassembly also serves as the back cover of the entire unit and includes the inlet and outlet ports. A bearing in this cover and one in the housing support the drive shaft.

(TYPICAL FIXED DISPLACEMENT UNIT)



(TYPICAL VARIABLE DISPLACEMENT UNIT)

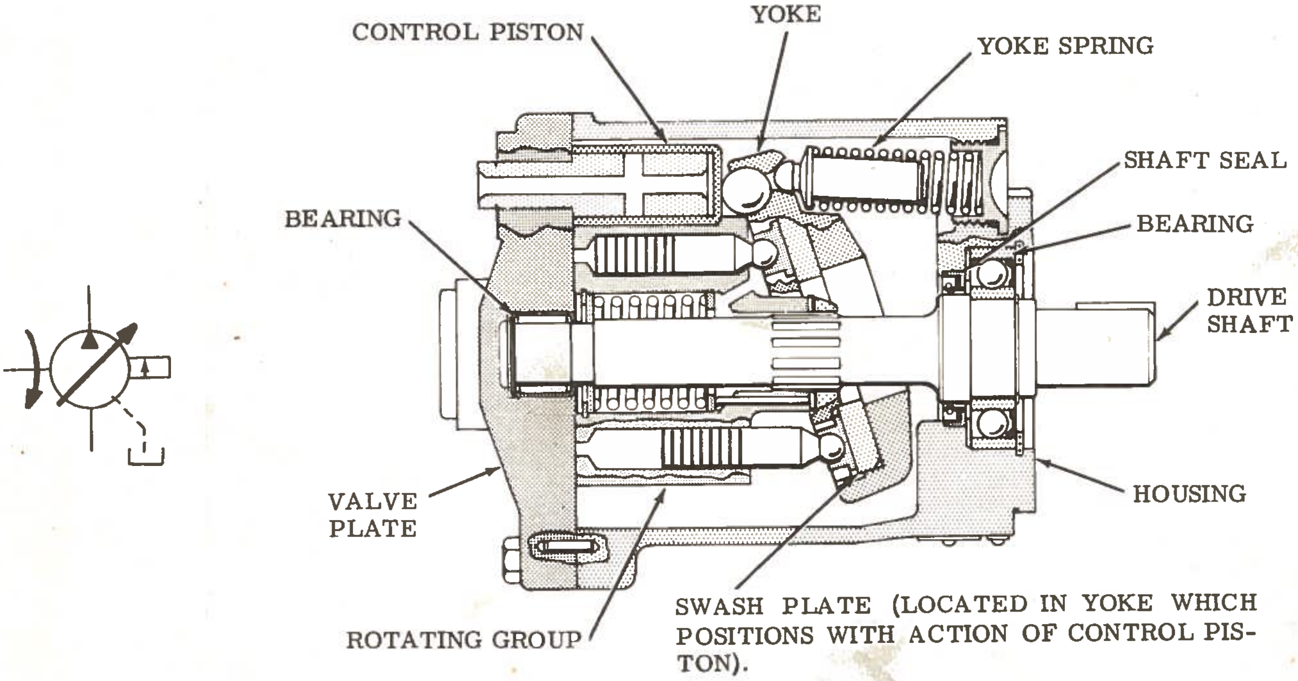


Figure 1. Typical Unit Assembly.

Section III · PRINCIPLES OF OPERATION

A. GENERAL

Although nearly identical in design, pumps and motors operate essentially in reverse of each other – the pump forcing fluid through the system as it rotates, the motor being rotated by the fluid. Variable displacement units are constructed so that the angle of displacement (angle of the swash plate to the drive shaft axis) can be varied by changing the yoke position.

B. MOTORS

Motors are positive displacement units which are capable of producing a variable torque and speed. Motor speed is a function of the input fluid volume and torque is a function of the input pressure. On a variable displacement motor, the angle of displacement (swash plate angle) also affects the speed and torque.

In operation, pressurized fluid is forced into the cylinder block bores which are open to the inlet port. Inlet pressure causes the pistons to exert a force against the swash plate. At the control point of the piston shoe and swash plate, a component of the angular counter-force causes the cylinder block to move in a rotary direction. The remaining cylinder block bores are either open to the outlet or blocked by the valve plate. When the pistons move across the outlet port, fluid discharges and returns to the reservoir or system.

Rotation is reversed by reversing the fluid supply to the motor or if the motor is a variable displacement type, it can be stroked across-center for reversal. If a variable unit is stroked across center, adequate precautions must be taken to prevent overspeed, overpressure and/or cavitation. "Stroking across center" means moving the swash plate from an angle on one side of center, to zero (center) angle of the yoke, and then to the opposite side of center.

Motors are used for continuous, intermittent, or continuously reversing service. They can be stalled indefinitely under load without damage when protected by a relief valve.

C. PUMPS

The operation of the pump is essentially in reverse of motor operation. During the time that a piston is moving out of the cylinder block bore, a pressure differential develops which forces fluid into the open cylinder block bores through the inlet port. As the cylinder block rotates past the outlet port, the pistons force fluid out into the system.

On variable displacement pumps, outlet volume is varied by changing the swash plate angle between the swash plate and the drive shaft axis. Since the swash plate angle is not variable on fixed displacement pumps, the flow is determined by pump size and speed driven (RPM).

Section IV · INSTALLATION

A. GENERAL

Installation drawings shown in Table 1 should be consulted for correct installation information.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

> Pump/motor shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawings. (See Table 1.)

A pilot on the pump/motor mounting flange assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

Mount the unit with the drain line connection at the top. This will allow easy filling of the housing before start-up and also prevent draining of the housing in periods of idleness. There should be no restriction between the drain port and the reservoir. The drain line must terminate below reservoir fluid level.

C. INLET LINE

Inlet lines must have sufficient capacity to allow full flow requirements at the pump or motor inlet for all conditions of operation. The use of restrictive inlet tubing, undersize filter or an improper grade of fluid may result in inlet vacuum conditions exceeding the recommended five inches of mercury and cause cavitation in pumps. Cavitation is the rapid formation and collapse of vapor pockets within the fluid and can cause excessive damage to the unit. Motor inlet lines must be of the high pressure type to withstand the output pressure of the associated pump. Check the appropriate installation drawing for maximum motor/pump speed. (See Table 1.)

D. FILTRATION

Vickers recommends the use of inlet, pressure and/or return line filtration. Inlet filters can be supplied with magnets and a contamination indicator or an electrical switch. The electrical switch feature can be used to actuate an alarm when the filter element is plugged. Vickers field engineering personnel should be consulted when unusual fluids or viscosity conditions are encountered.

E. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing and pickling.

NOTE

> For instructions on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulance and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

F. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps and motors. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet I-286-S for oil selection is available from Vickers Technical Publications, Troy, Michigan 48084.

Oil recommendations noted in the data sheet is based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Vickers sales engineer.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of oil filters, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in hydraulic systems are:

1. Very high viscosities at start-up temperatures can cause noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity in discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

G. OVERLOAD PROTECTION

Both fixed and compensated pumps require an external relief valve to provide maximum protection of circuit components. An external relief valve is also required in the inlet line of a hydraulic motor to limit the pressure and torque.

H. STARTING AND PRIMING

Before initial starting, fill the housing with clean fluid. Normal "leakage" past the pistons or between the cylinder block and valve plate provides internal lubrication of working parts. To assure initial priming of variable displacement units, adjust the controls to provide at least 40% of maximum displacement at start-up. The control may be reset to a lower displacement after priming is accomplished.

It may be necessary to bleed air from the pump outlet line to permit priming and reduce noise. Bleeding may be accomplished by loosening an outlet connection until a solid stream of fluid appears. An automatic air bleed valve (ABT-02-10) can be permanently installed and will eliminate the necessity to loosen a connection.

Section V - SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following standard tools are required for overhaul of a piston type pump or motor:

1. Torque wrench with socket adapters
2. Set of U.S. hex key wrenches
3. Set of small pin punches
4. 3/8 inch socket set with ratchet
5. Small ball peen hammer
6. Steel scale
7. Micrometer (0-1 inch)
8. Dial indicator

An arbor press is also required for assembly of shaft and pintle bearings.

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be cleaned regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher than normal pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak.

5. A pump or motor which is running excessively hot or noisy is a potential failure. Should a unit become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of shaft couplings should be as specified by their manufacturers.

F. REPLACEMENT PARTS

Reliable operation through the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and materials are used in the manufacture of our parts Substitutions may result in early failure. Part numbers are shown in the parts drawings listed in Table 1.

G. TROUBLESHOOTING

Table 3 lists the common difficulties experienced with piston pumps and motors. It also indicates probable causes and remedies for each of the troubles listed.

Section VI - OVERHAUL

A. GENERAL

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure.

After removing pump or motor from system and before disassembly, cap or plug all ports and disconnected lines. Clean the outside of the unit thoroughly to prevent entry of dirt into the system.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

NOTE

Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

B. DISASSEMBLY

All models are disassembled in the same general sequence as shown in the exploded view, Figure 2.

NOTE

This procedure is written for a basic compensator model. If a control other than a compensator is used, refer to the appropriate service parts drawing for information on the control.

Parts should be placed on a clean piece of Kraft paper in the order of disassembly.

1. Remove four screws (1) from compensator body (2).

2. Remove compensator body (2) from valve plate subassembly (7).

3. Remove gasket (3), "O" ring (4) and retaining ring (5) from piston rod (9).

4. Remove six screws (6) from valve plate subassembly (7).

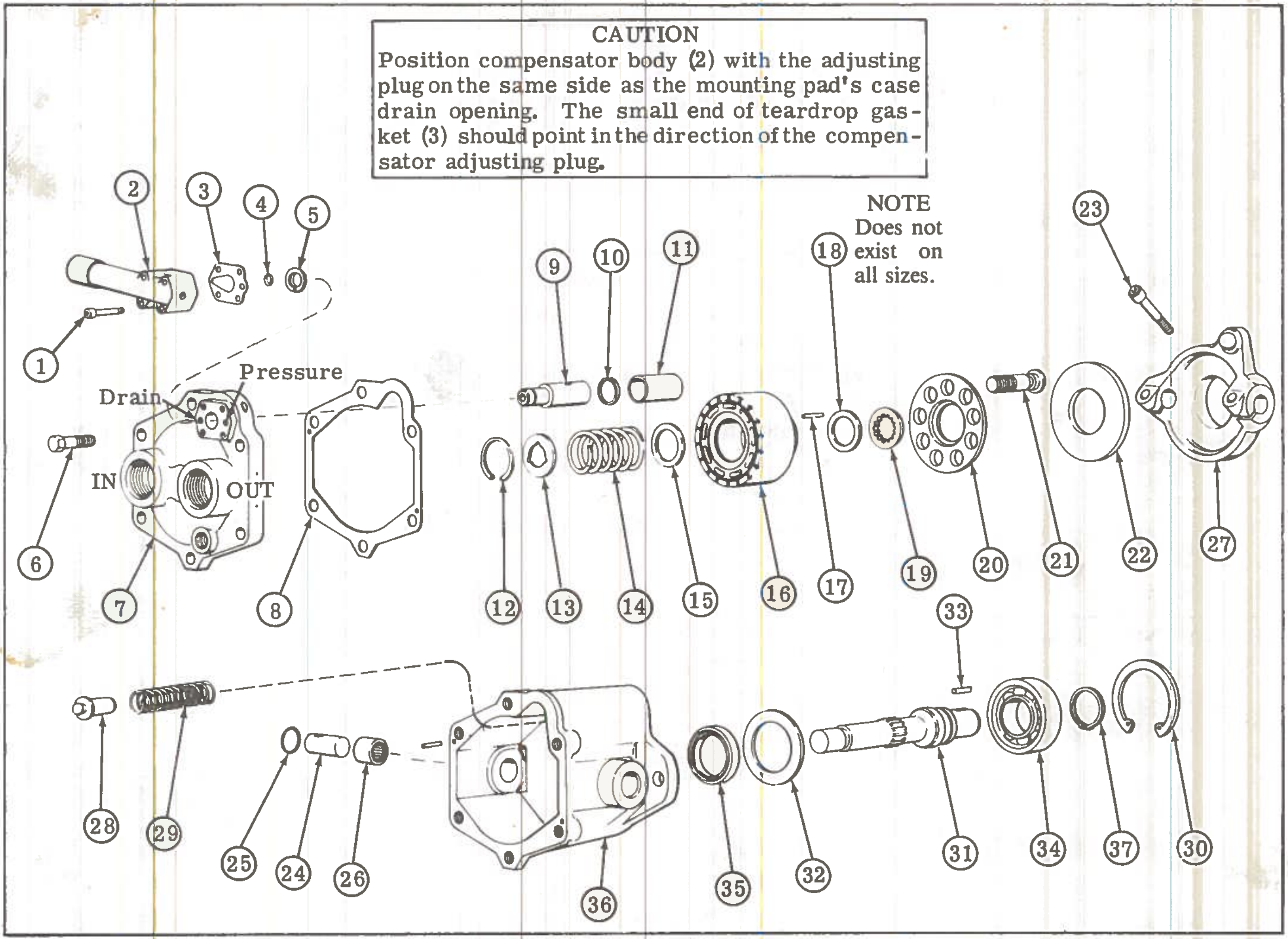
5. Remove valve plate subassembly (7) from housing (36). Place valve plate subassembly on a clean piece of Kraft paper with machined surface up. Remove piston rod (9), spacer (10) and piston (11) from valve plate (7). (Note: Spacer does not exist in all models.)

6. Remove gasket (8) and discard.

TROUBLE	PROBABLE CAUSE	REMEDY
PUMP NOT DELIVERING FLUID	Reservoir fluid level low.	Add fluid and check level on both sides of reservoir baffle to insure pump intake line is submerged.
	Intake filter or pipe plugged.	Clean filters of lint soon after new fluid is added.
	Air leak in intake line prevents priming.	Pour fluid on intake joints while listening for change in sound of operation. Tighten as required.
	Coupling or shaft sheared or disengaged.	Disassemble pump and check shaft and rotating group for damage. Replace necessary parts.
	Pump driven in wrong direction of shaft rotation.	Check installation. Reverse the drive or convert pump as discussed in the overhaul section.
SYSTEM NOT DEVELOPING PRESSURE	Contamination in actuating control.	Clean control
	Pump not delivering fluid for any of the above reasons.	Check circulation by watching fluid in reservoir.
	Relief valve setting not high enough.	Block machine travel. Test with pressure gauge.
	Relief valve sticking open.	Remove contamination in relief valve.
	Leak in hydraulic control system (cylinders or valves).	Test independently by progressively blocking off the circuit.
	Free circulation of fluid to reservoir.	Insure that directional valve is not in open center (neutral) position or that fluid is not discharging to tank through an open line or improperly adjusted valve.
PUMP MAKING NOISE	Partly clogged intake line, intake filter, or restricted intake pipe.	Pump must receive intake fluid freely or cavitation takes place.
	Air leak at pump intake pipe joints.	Tighten as required. Pour fluid on joints while listening for change in sound of operation.
	Air bubbles in fluid.	Check to be certain return lines are below fluid level and well separated from intake line.
	Reservoir air vent plugged.	Must be open through breather opening or air filter.
	Pump running too fast.	Conform with recommended maximum speeds on installation drawings.
	Filter too small on intake.	Refer to appropriate installation drawing for proper size filter.
	Coupling misalignment.	Check for damaged shaft bearing or other parts. If necessary, replace and realign the coupled shafts.
MOTOR SHAFT DOES NOT TURN. INSUFFICIENT SPEED OR POWER.	System overload relief valve set too low to permit necessary pressure.	Check pressure and increase relief valve setting, but not above recommended maximum.
	Valve plate and cylinder block surface scored by abrasive in hydraulic fluid.	Check external leakage at drain port. Remove motor. Install new rotating group. Replace scored valveplate. Flush system with clean oil.
MOTOR TURNING IN WRONG DIRECTION	Pump or other components in system not functioning properly.	Check directional control and pump stroke position.
	Incorrect connection.	Check circuit and connect correctly.
EXTERNAL LEAKAGE FROM MOTOR	Worn seal or gaskets.	Install new seal and/or gaskets.
	Gaskets leaking due to improperly connected reservoir drain.	Connect drain line directly to reservoir below the fluid level.
SPEED FLUCTUATIONS WITH CONSTANT INPUT FLOW	Irregular wear between valve plate and cylinder block.	Replace damaged parts.

Table 3. Troubleshooting Pumps/Motors

7. The rotating group consists of retaining ring (12), lift limiter (13), spring (14), thrust washer (15), cylinder block (16), pins (17), backup washer (18), spherical washer (19), shoe plate (20) and piston/shoe subassembly (21). Turn the rotating group slightly to free it from the swash plate (22). Tilt housing (36) and remove the rotating group. During removal, use care to prevent separation of the rotating group. Disassemble the rotating group as follows: (Refer to Figures 2 and 3 during disassembly.)


CAUTION
Position compensator body (2) with the adjusting plug on the same side as the mounting pad's case drain opening. The small end of teardrop gasket (3) should point in the direction of the compensator adjusting plug.

NOTE
Does not exist on all sizes.

Figure 2. Exploded Parts Breakdown

ITEM	NOMENCLATURE	QTY.
1	Screw (Compensator)	4
2	Body (Compensator)	1
3	Gasket (Compensator)	1
4	"O" Ring (Compensator)	1
5	Retaining Ring (Compensator)	1
6	Screw	6
7	Valve Plate	1
8	Gasket	1
9	Piston Rod	1
10	Spacer	1
11	Piston	1
12	Retaining Ring	1
13	Lift Limiter Washer	1
14	Spring	1
15	Thrust Washer	1
16	Cylinder Block	1
17	Pin	3
18	Backup Washer	1
19	Spherical Washer	1
20	Shoe Plate	1
21	Piston/Shoe Subassembly	9
22	Swash Plate	1
23	Screw (Yoke)	2
24	Pintles	2
25	"O" Ring (Pintle)	2
26	Bearing (Pintle)	2
27	Yoke Subassembly	1
28	Seat	1
29	Spring	1
30	Retaining Ring	1
31	Drive Shaft	1
32	Shaft Seal Retainer	1
33	Drive Shaft Key	1
34	Bearing (Drive Shaft)	1
35	Shaft Seal	1
36	Housing	1
37	Retaining Ring (Bearing)	1

Figure 2. Part Nomenclature

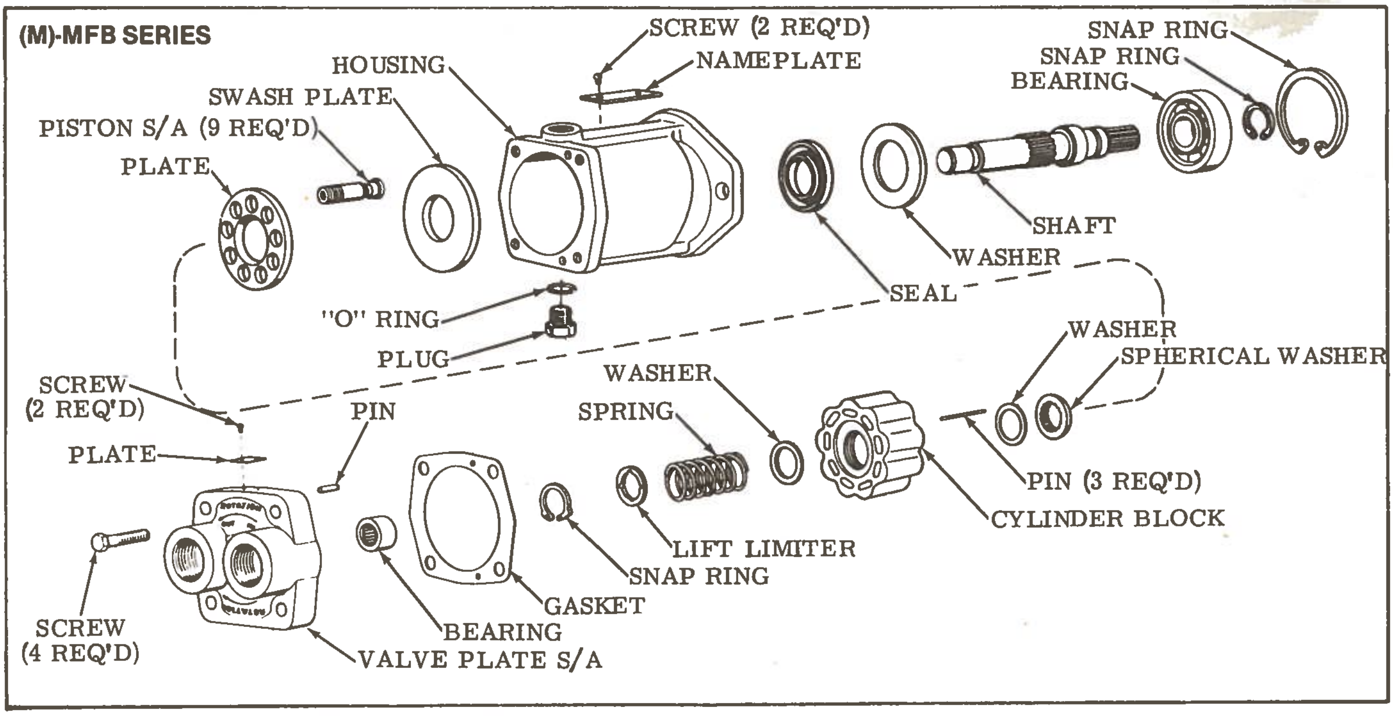
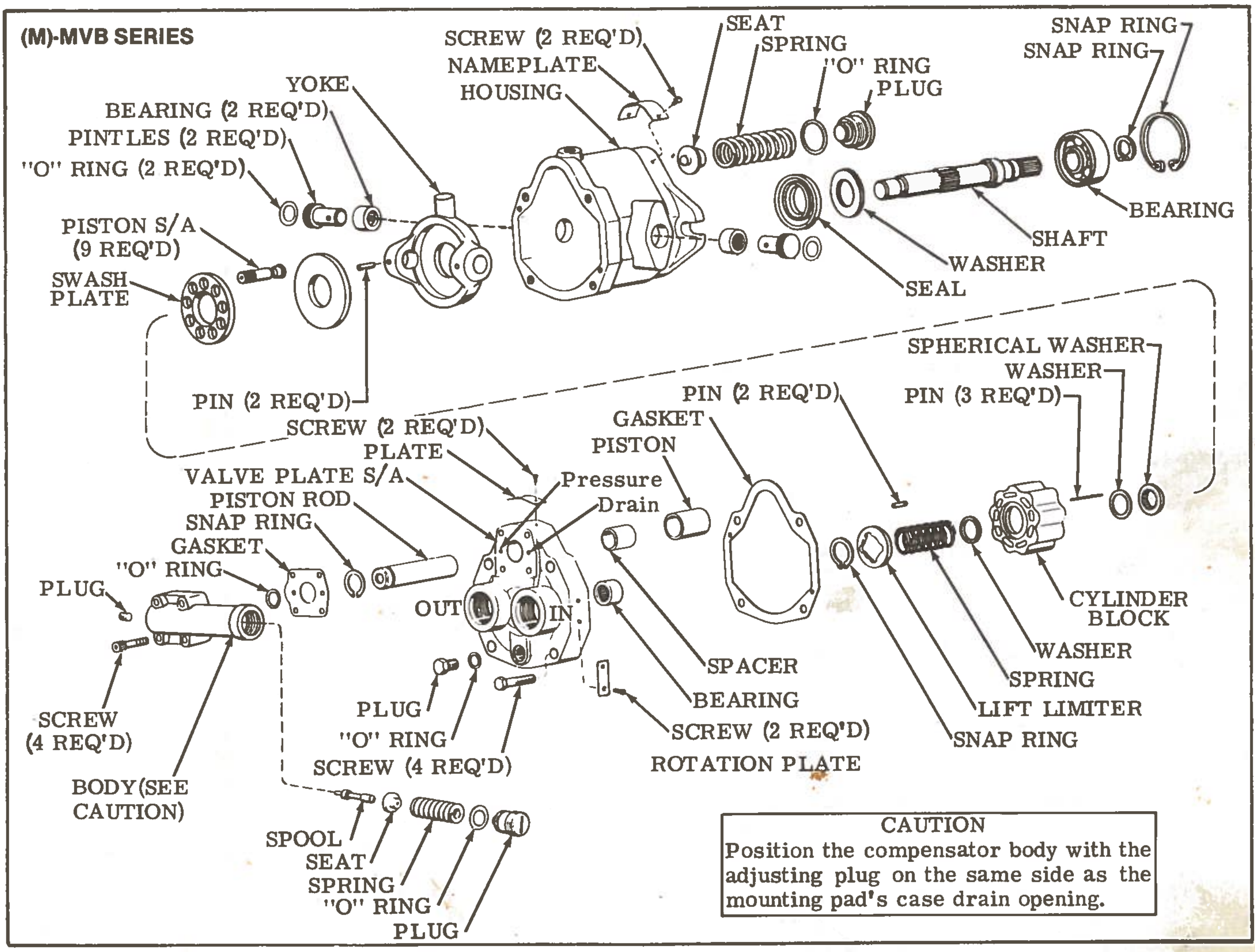


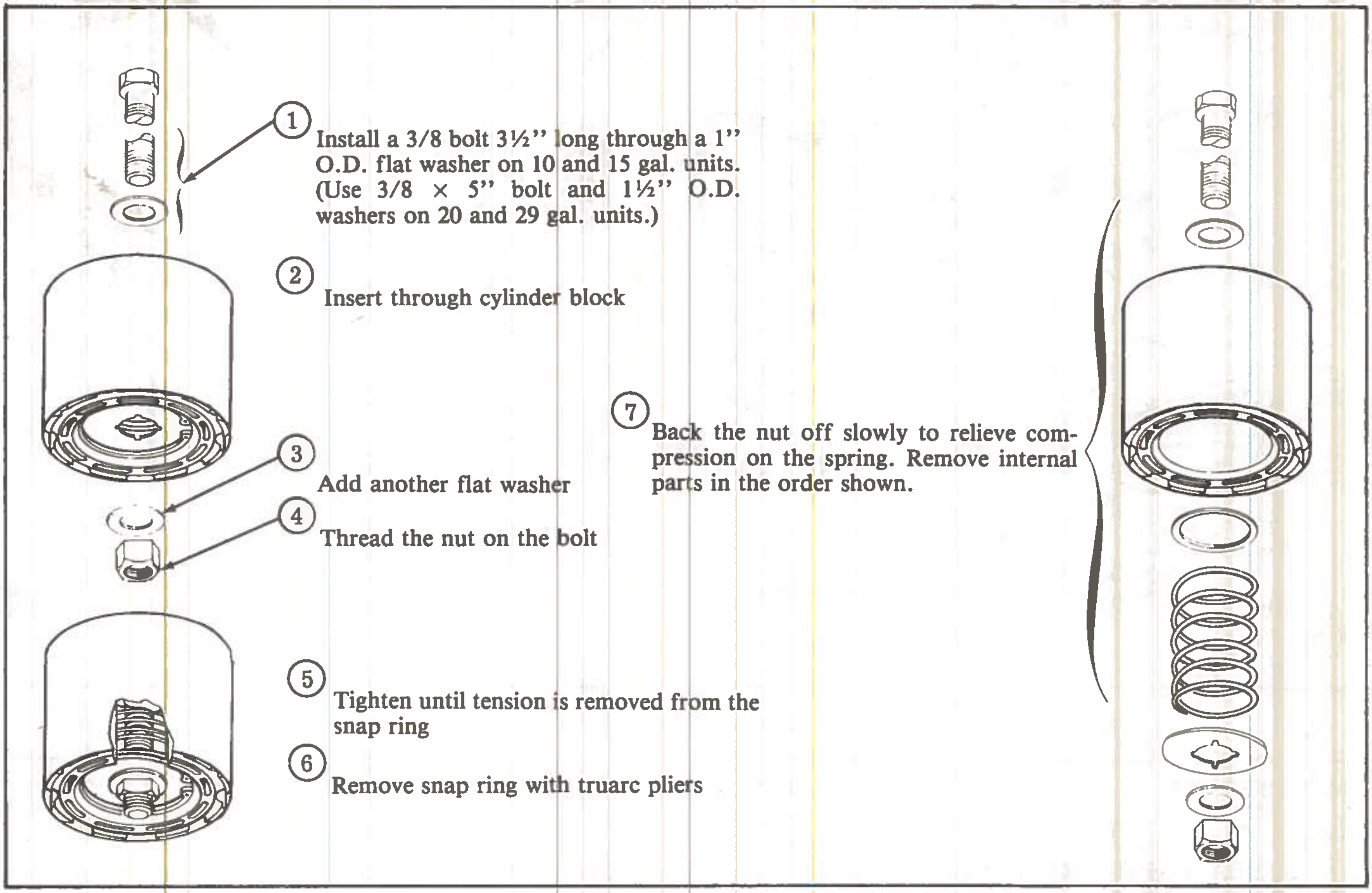
Figure 2a. Typical Fixed Displacement Motor



CAUTION

Position the compensator body with the adjusting plug on the same side as the mounting pad's case drain opening.

Figure 2b. Typical Variable Displacement Motor



① Install a 3/8 bolt 3½" long through a 1" O.D. flat washer on 10 and 15 gal. units. (Use 3/8 × 5" bolt and 1½" O.D. washers on 20 and 29 gal. units.)

② Insert through cylinder block

③ Add another flat washer

④ Thread the nut on the bolt

⑤ Tighten until tension is removed from the snap ring

⑥ Remove snap ring with truarc pliers

⑦ Back the nut off slowly to relieve compression on the spring. Remove internal parts in the order shown.

Figure 3. Cylinder Block Disassembly

a. Place the rotating group face down on a clean piece of Kraft paper.

b. Grasp shoe plate (20) and lift nine piston and shoe subassemblies (21) from cylinder block (16) with the shoe plate. Be careful not to strike the pistons together hard enough to create a burr or damage the pistons.

c. Remove spherical washer (19), backup washer (18) and pins (17). (Note: Some units do not use a backup washer.)

d. Observe caution during removal of spring (14) located within the cylinder block. The spring is under high compression and can cause bodily harm if retaining ring (12) is removed without adequate tooling. See Figure 3 for removal procedure.

8. Remove retaining ring (30) from housing (36) with truarc pliers.

9. Remove drive shaft (31), bearing (34), key (33), and retaining ring (37) from mounting flange of housing (36). Set aside for inspection.

10. Remove swash plate (22) from yoke subassembly (27). Rotate swash plate (22) and pull evenly from the yoke. Set aside for inspection.

11. Remove two screws (23) from yoke (27).

12. Remove pintles (24) with "O" rings (25) from yoke (27). Refer to Figures 4 and 5.

13. Remove yoke (27), refer to Figures 4 and 5, the yoke removal procedure for a variable displacement pump or motor.

14. Variable displacement units require removal of seat (28) and spring (29) from within housing (36).

15. Remove washer (32) and shaft seal (35) from the housing. Be careful during the removal of the shaft seal. DO NOT scratch the housing to seal mounting surface. Leakage can occur between the seal and housing if the aluminum housing is scratched.

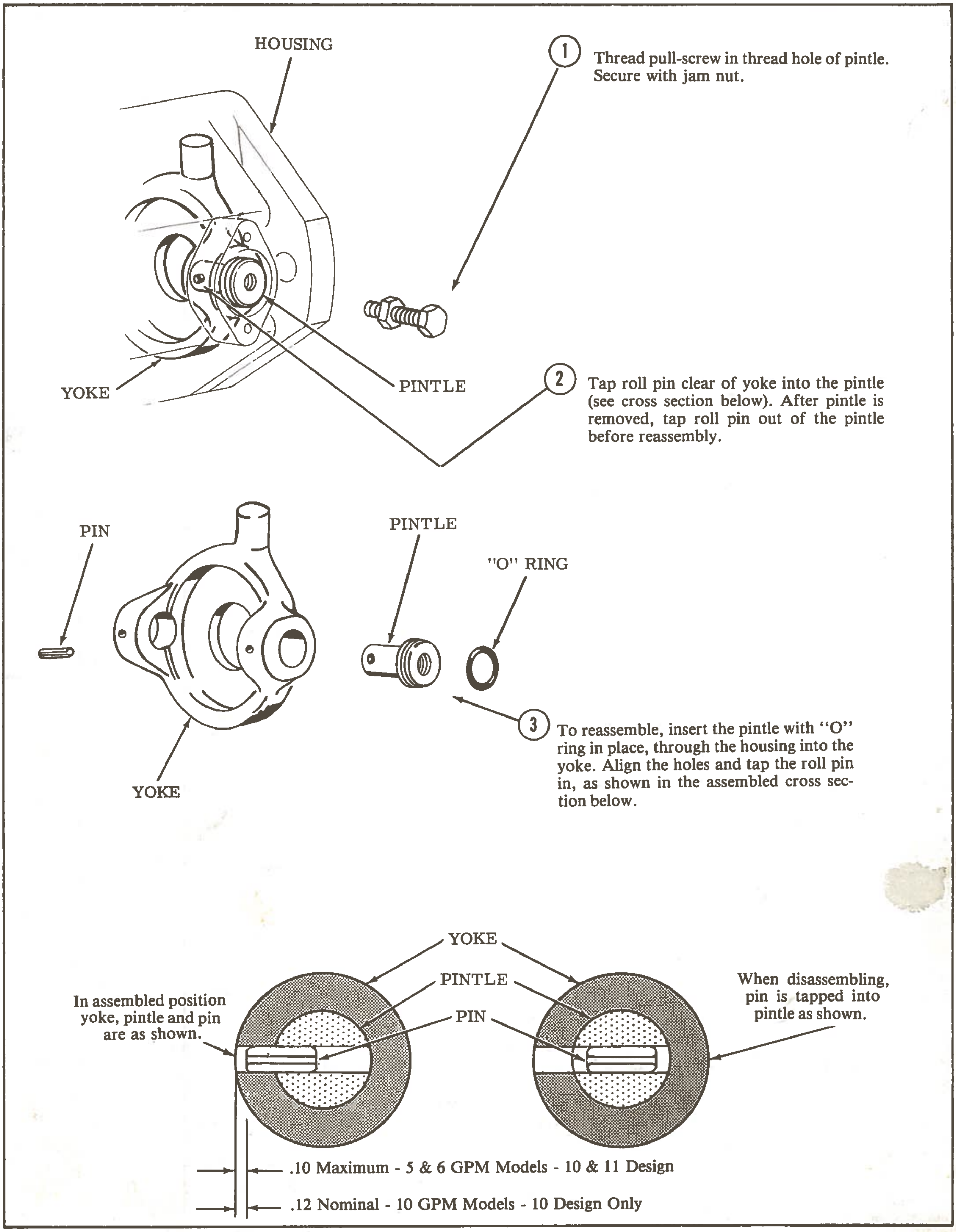
C. INSPECTION, REPAIR AND REPLACEMENT

Prior to inspection, clean all parts thoroughly with a solvent that is compatible with system fluid. Replace all parts that do not meet the following specifications.

1. Valve Plate (7) - Lapping of the valve plate is not recommended. If wear or scoring is apparent, replace the valve plate. Check the shaft bearing located within the valve plate for roughness and pitting of the rollers. Replace if defective. Remove paint and/or burrs from outer edge of valve plate with an India stone.

2. Piston Rod (9), Spacer (10) and Piston (11) - Inspect compensator piston rod and piston for fit and/or wear. Spacer (10) is used on some models to limit maximum flow. Replace if defective.

3. Rotating Group Parts


HOUSING
1
2
YOKE
PINTLE
PIN
PINTLE
"O" RING
3
YOKE
YOKE
PINTLE
PIN
.10 Maximum - 5 & 6 GPM Models - 10 & 11 Design
.12 Nominal - 10 GPM Models - 10 Design Only

① Thread pull-screw in thread hole of pintle. Secure with jam nut.

② Tap roll pin clear of yoke into the pintle (see cross section below). After pintle is removed, tap roll pin out of the pintle before reassembly.

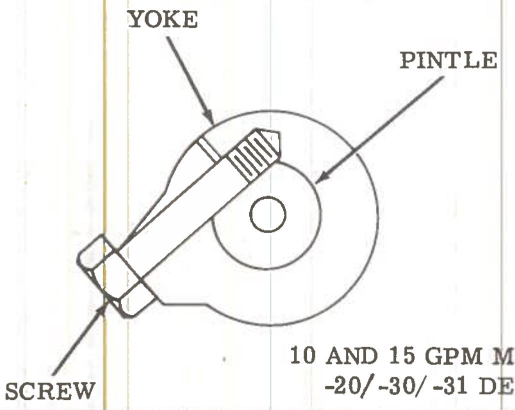
③ To reassemble, insert the pintle with "O" ring in place, through the housing into the yoke. Align the holes and tap the roll pin in, as shown in the assembled cross section below.

In assembled position yoke, pintle and pin are as shown.

When disassembling, pin is tapped into pintle as shown.

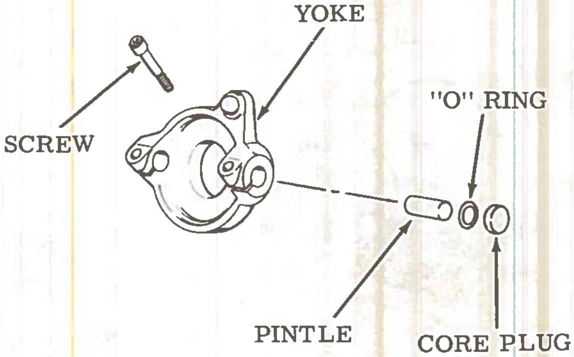
Figure 4. Removal of Pintle and Yoke, Smaller Models

The 10 and 15 GPM units of the -20/30/31 designs use a screw in lieu of the roll pin for securing pintles. The pintles are provided with a groove in place of the drilled hole to accept the screw (see cross section below).



10 AND 15 GPM MODELS
-20/-30/-31 DESIGN

(1) Remove the core plug. Back-off lock screw at yoke until pintle groove clears for 20 and 29 GPM models. Lightly tap pintle toward inside of unit to remove. NOTE: Swash plate must be removed from yoke to remove these pintles.



(2) To reassemble, insert the pintle through the housing into the yoke. Align the grooves and thread in lock screw.

20 AND 29 GPM MODELS

Figure 5. Removal of Pintle and Yoke, Larger Models

a. Inspect shoe plate (20) for wear or cracking in the area of spherical washer (19). If wear or cracks are found, replace the shoe plate and spherical washer at the same time.

b. Check spherical washer (19) for burrs and wear. Replace if defective.

c. Inspect pins (17) for equal length, wear and possible bending. Replace all pins simultaneously if one is defective.

d. Backup washer (18) does not exist in all models. Check for wear and replace if necessary.

e. Check each cylinder block (16) bore for excessive wear. Use the piston/shoe subassemblies (21) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding occurs, clean the cylinder block and piston, lubricate with clean hydraulic fluid and try again. Even minor contamination of the fluid can cause the piston to freeze up in the cylinder block bore.

f. Inspect each piston and shoe subassembly (21) for a maximum end play of 0.003 inch between the piston and shoe. The face thickness dimension, as shown in Figure 6, of each shoe must be within 0.001 inch of each other. A variation greater than 0.001 inch between all nine shoes indicates excessive wear. If one shoe needs replacement, replace all piston/shoe subassemblies. Replacement as a matter of procedure is recommended to obtain maximum overhaul life of the unit.

g. Inspect retaining ring (12), lift limiter washer (13), spring (14) and thrust washer (15) within cylinder block (16) for wear. Replace if necessary.

4. Inspect the face of swash plate (22) for wear, scratches and possible fracture. If the swash plate needs replacement, make sure the new swash plate rests flat against the face of yoke subassembly (27).

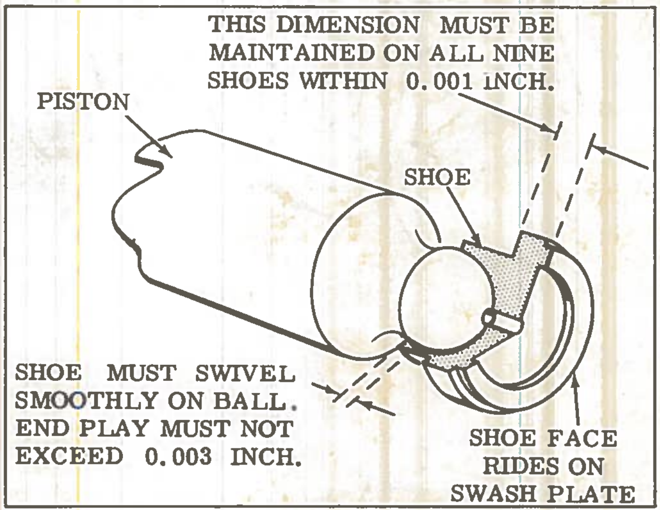

THIS DIMENSION MUST BE MAINTAINED ON ALL NINE SHOES WITHIN 0.001 INCH.
PISTON
SHOE
SHOE MUST SWIVEL SMOOTHLY ON BALL. END PLAY MUST NOT EXCEED 0.003 INCH.
SHOE FACE RIDES ON SWASH PLATE

Figure 6. Piston and Shoe Assembly Tolerances

5. Inspect drive shaft (31) for wear, a chipped spline and burrs. Remove burrs with an India stone. Inspect the contact area of the shaft seal for wear and/or scoring. Replace the drive shaft if wear or scoring is greater than 0.005 T.I.R. (total indicator reading).

6. Inspect drive shaft bearing (34) for roughness in turning, pitting of the rollers and excessive end play. Replace if defective. If the bearing or shaft require replacement, removal of the bearing from the shaft is required. Use appropriate tooling to hold the inner race of the bearing and press the shaft from the bearing. Assemble new parts together in a similar manner, always applying force to the shaft and inner race of the bearing. DO NOT apply force to the outside bearing race. Install retaining ring (37).

7. Inspect yoke subassembly (27) face for wear, roughness or scoring. Check pintle bores of yoke for wear. Replace if defective.

8. Inspect pintles (24) and pintle bearings (26) for wear. Replace if defective. If a pintle bearing requires replacement, use a tool smaller than the housing bore and drive the pintle bearing into the housing and remove. Be careful not to score the housing bore during removal. Clean up the bore and lubricate both the bore and new pintle bearing with system fluid. Be very cautious during installation of new pintle bearings. If a bearing is misaligned with the bore at start of press, the bearing cage will warp and a bind will occur. Use an arbor press to install new pintle bearings. DO NOT press a bearing past the inside lip of the housing or interference with the yoke will result.

9. Inspect housing (36) mounting flange for nicks and burrs. Remove with an India stone. Remove paint and/or burrs from outer edge of housing.

D. ASSEMBLY

Assembly is performed in the reverse order of disassembly. Special procedures are noted in the following text.

A new seal kit should be obtained. Refer to the parts drawing for your model (see Table 1). Replace all seals, gaskets and "O" rings with new ones from the kit. A light film of clean hydraulic fluid will provide ease of assembly and initial lubrication of moving parts. Assemble as follows:

1. Install new shaft seal (35) into housing (36) with spring loaded member facing into the housing.

2. Install spring (29) over spring guide in housing. Insert seat (28) into spring.

3. Install yoke (27) in housing (36) as illustrated in Figures 4 and 5. Make sure seat (28) is in position and engages within the yoke.

4. Install pintles (24) and "O" rings (25) as illustrated in Figures 4 and 5. Install screws (23) and torque to recommended values. Refer to parts drawing for applicable unit found in Table 1.

5. Place shaft seal retainer (32) over shaft seal. Install drive shaft (31) and retaining ring (30) up against bearing into housing groove.

6. Lubricate and install swash plate (22) with chamfer side facing yoke (27). It is important that the swash plate be properly seated within the yoke and can be freely moved (rotated) with the fingers.

7. If the cylinder block was disassembled, refer to Figure 3 for assembly. Place the cylinder block face down on a clean piece of Kraft paper and insert three pins (17) into the cylinder block. Lubricate back-up washer (18) (not used on some models) and spherical washer (19), place them over pins (17). Lubricate the cylinder block bores and pistons with system fluid. Install the nine pistons (21) through shoe plate (20) and into the cylinder block bores. The pistons must move freely within the bores. The rotating group is now assembled and ready for installation into the pump or motor housing. Hold cylinder block (16) and shoe plate (20) together to keep pins (17) and washer(s) (18 & 19) intact, then install rotating group over the drive shaft. A slight rotation of the drive shaft during assembly will help align spherical washer (19) and cylinder block (16) splines with those of the shaft.

8. Lubricate the face of the valve plate. Make sure paint and burrs have been removed from the outer edge of housing (36) and valve plate (7). Install gasket (8) on housing (36).

9. Install piston rod (9) into valve plate. Slide retaining ring (5) over piston rod (9) and into retaining ring groove. Install spacer (10) (used only on models with reduced flow capability), and piston (11) over piston rod (9).

10. Align drive shaft to bearing and install valve plate (7) on housing (36). Thread retaining screws (6) through valve plate and into housing. Torque to the values noted in parts drawing for the unit.

11. Lubricate and install "O" ring (4) in "O" ring groove of piston rod (9). Install gasket (3) on valve plate (7). CAUTION: Position gasket as shown in Figure 2 with teardrop hole pointing toward compensator adjusting screw.

12. Place compensator body (2) over gasket (3) on valve plate (7). Make sure body of compensator and gasket are installed in the correct position for shaft rotation (see Figure 2). Thread retaining screws (1) through compensator into valve plate. Torque screws to the values noted on parts drawings for the unit.

13. Install drive shaft key (33) into drive shaft (31). Make sure key is seated properly.

E. CONVERSIONS

When changing the direction of rotation of an inline hydraulic pump, it will become necessary to change to the respective valve plate for that rotation. If the pump happens to be a compensated type, the compensator must be rotated 180° and the compensator gasket must follow. Consult the appropriate parts drawing listed in Table 1 for the proper valve plate selection.

Hydraulic motors with "V" in the model code require only the rotation of the compensator to change direction. When a change such as this is made, it should be noted by a change in the name plate and any directional arrows as an aid in future identification.

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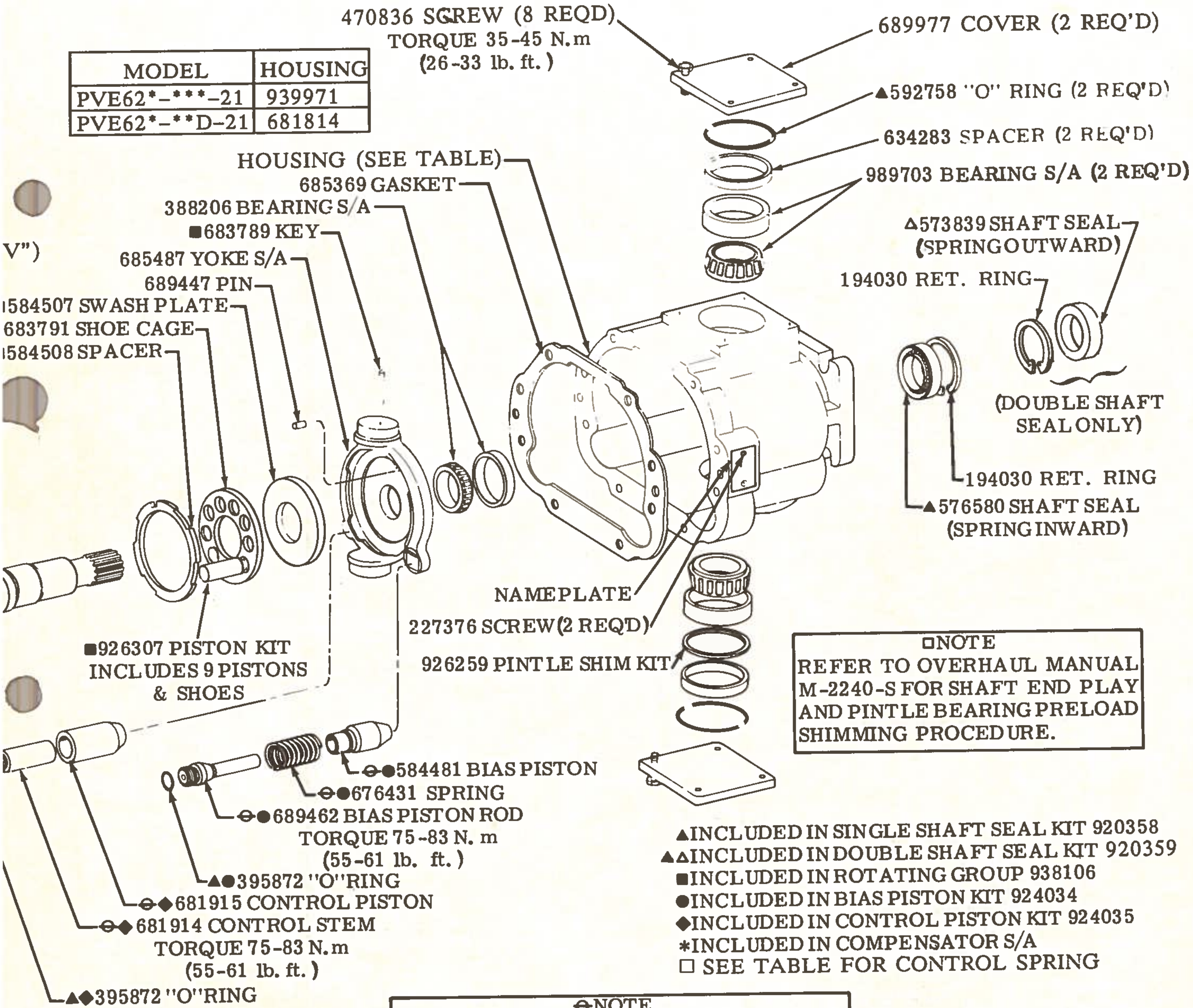
MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)

MODEL	HOUSING
PVE62*-***-21	939971
PVE62*-**D-21	681814



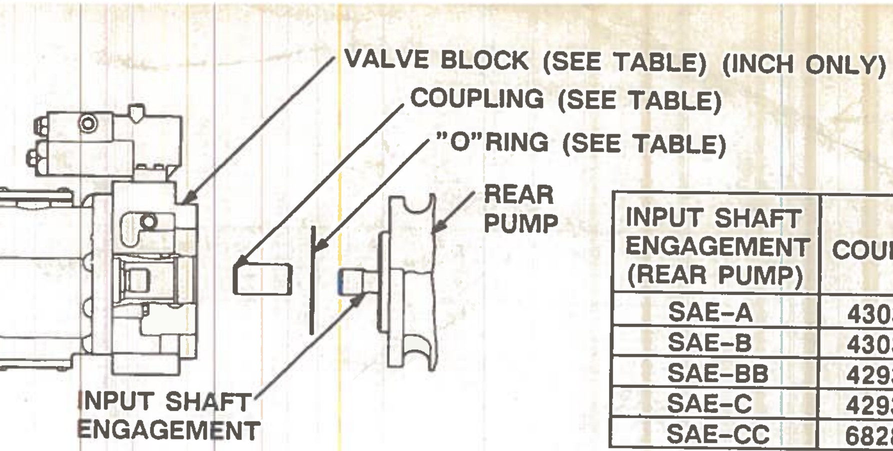
☐NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

▲INCLUDED IN SINGLE SHAFT SEAL KIT 920358
▲△INCLUDED IN DOUBLE SHAFT SEAL KIT 920359
■INCLUDED IN ROTATING GROUP 938106
●INCLUDED IN BIAS PISTON KIT 924034
◆INCLUDED IN CONTROL PISTON KIT 924035
*INCLUDED IN COMPENSATOR S/A
☐ SEE TABLE FOR CONTROL SPRING

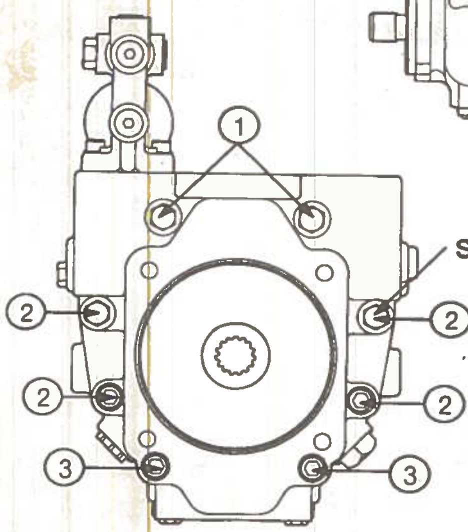
TE
KED ▲ INCLUDED
HAFT SEAL KIT.

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.

THRU-DRIVE MODELS



INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	430359
SAE-B	430360
SAE-BB	429368
SAE-C	429369
SAE-CC	682898



SCREW NO.	SCREW QTY	SCREW
1	2	470877
2	4	470870
3	2	470874
TORQUE 65-75N.m (48-55 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK (THRU-DRIVE)	"O"RING
PVE62R	B	522293	401525
PVE62R	C	685415	353264
PVE62L	C	522155	

MODEL CODE BREAKDOWN

P V E 62(QI) * - * * (M) (D) - 21 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

62 - 62 GPM @ 1800 RPM (8.0 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

3 - SPLINED
13 - STRAIGHT KEYED
16 - STRAIGHT KEYED

9 PORT DESIGNATION

BLANK - 4 BOLT FLANGE (INCH)
M - METRIC

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

Litho in U.S.A.

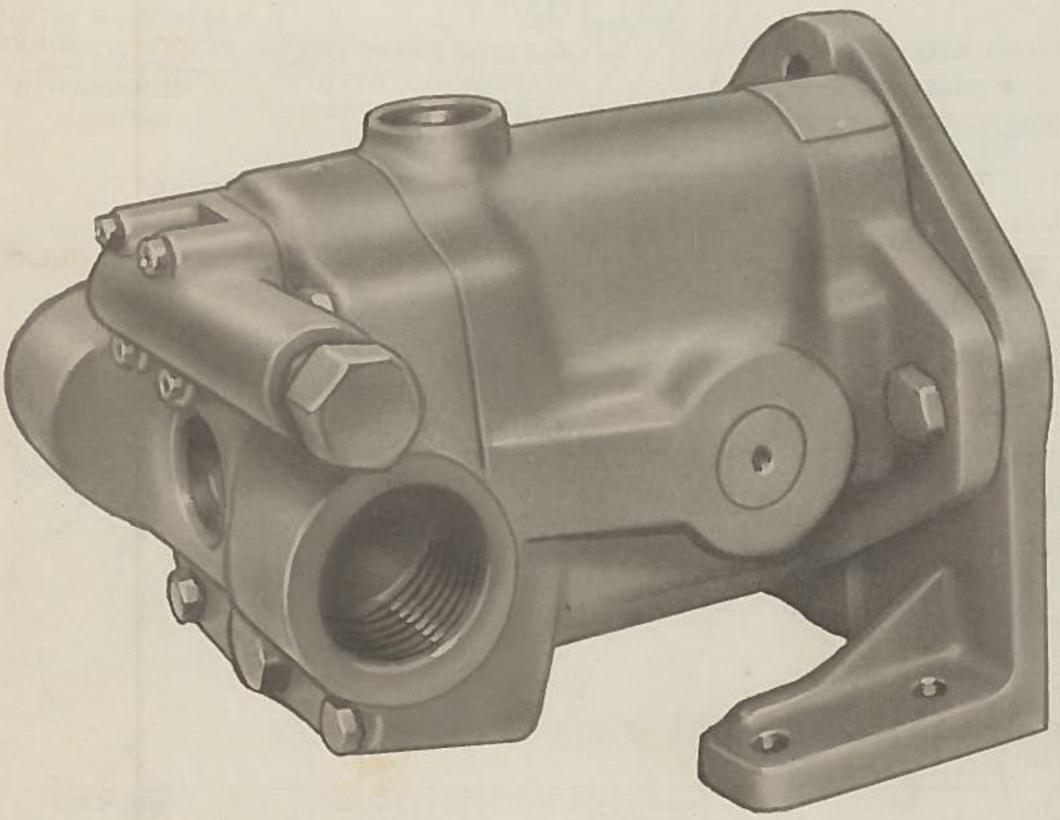
VICKERS®
A TRINOVA COMPANY

Service Parts Information

10 & 15 GPM Variable Thru Shaft, Side Ported, Inline Piston Pumps

PVB10-(F)**WY-30/31-*(*)(L)-1*
PVB10-(F)**XY-30/31-*(*)(L)-1*
PVB15-(F)**WY-30/31-*(*)(L)-1*
PVB15-(F)**XY-30/31-*(*)(L)-1*

④



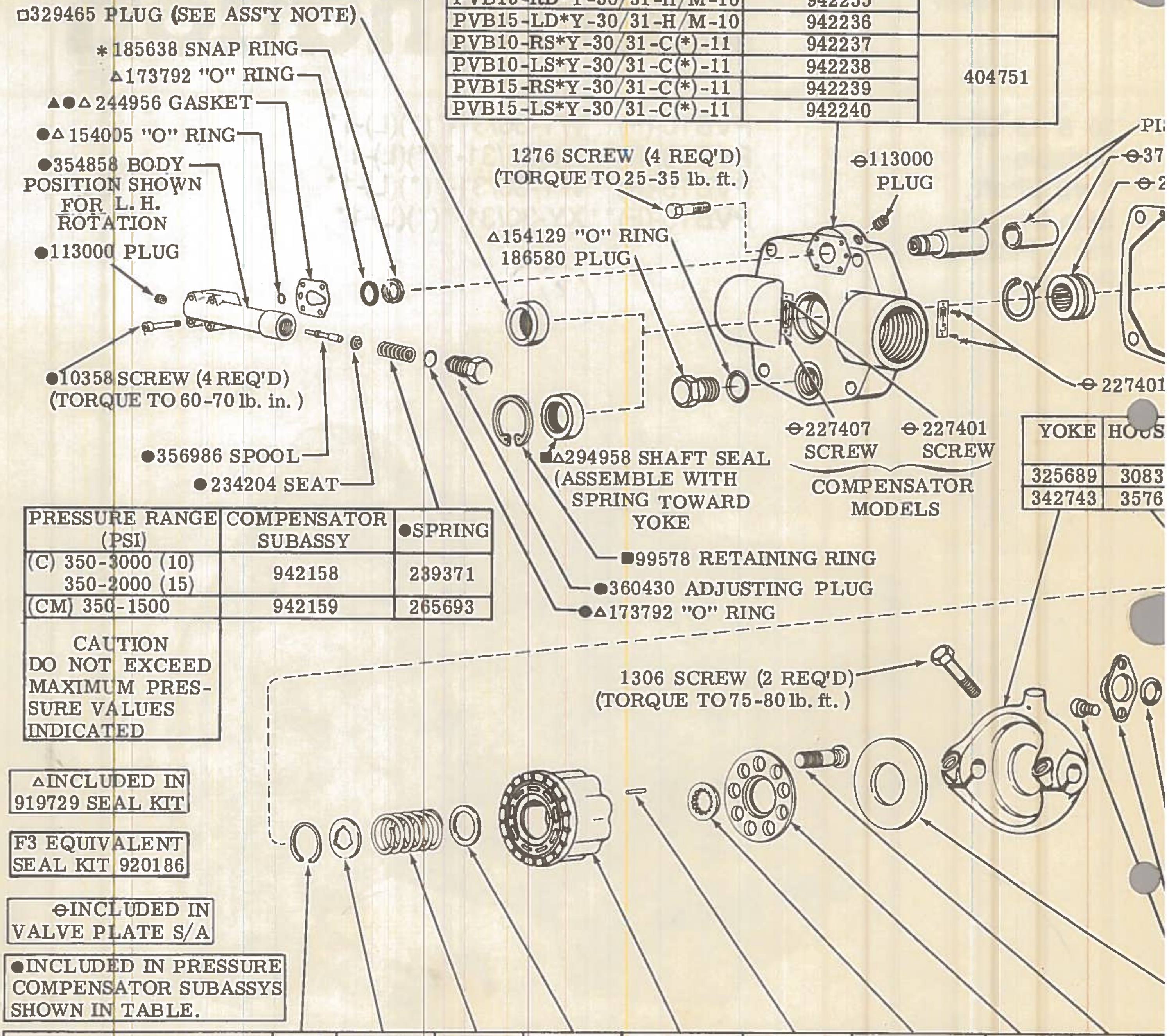
Vickers, Incorporated
1401 Crooks Road
Troy, Michigan 48084

Revised 5-1-87

I-3282-S

▲CAUTION
Position gasket with small end of tear-drop hole pointing in direction of compensator adjusting plug.

MODEL	⊖VALVE PLATE SUBASSY	⊖ROTATION PLATE
PVB10-RD*Y-30/31-H/M-10	942233	195060
PVB10-LD*Y-30/31-H/M-10	942234	
PVB15-RD*Y-30/31-H/M-10	942235	
PVB15-LD*Y-30/31-H/M-10	942236	
PVB10-RS*Y-30/31-C(*)-11	942237	404751
PVB10-LS*Y-30/31-C(*)-11	942238	
PVB15-RS*Y-30/31-C(*)-11	942239	
PVB15-LS*Y-30/31-C(*)-11	942240	



YOKE	HOUS
325689	3083
342743	3576

PRESSURE RANGE (PSI)	COMPENSATOR SUBASSY	●SPRING
(C) 350-3000 (10) 350-2000 (15)	942158	239371
(CM) 350-1500	942159	265693

CAUTION
DO NOT EXCEED MAXIMUM PRESSURE VALUES INDICATED

△INCLUDED IN 919729 SEAL KIT

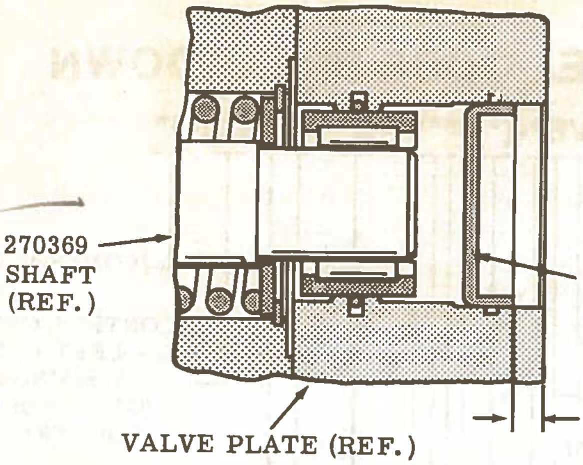
F3 EQUIVALENT SEAL KIT 920186

⊖INCLUDED IN VALVE PLATE S/A

●INCLUDED IN PRESSURE COMPENSATOR SUBASSYS SHOWN IN TABLE.

MODEL	RET. RING	LIFT LIMITER	SPRING	THRUST WASHER	CYLINDER BLOCK	PINS (3 REQ'D)	SPHERICAL WASHER	SHOE PLATE	PISTON S KIT
	THESE PARTS INCLUDED IN								
PVB10-***Y-30/31-**-1*	93509	245223	247294	241954	321703	248812	423324	275961	◆ 9420
PVB15-***Y-30/31-**-1*					260860				◆ 9418

NOTE: TYPE 'C' & 'CM' COMPENSATOR CONTROL PARTS SHOWN. SEE BACK PAGE FOR MANUAL CONTROLS. REFER TO PARTS DRAWING I-3243-S FOR 'CVP' PRESSURE LIMITING & LOAD SENSING COMPENSATOR CONTROL.

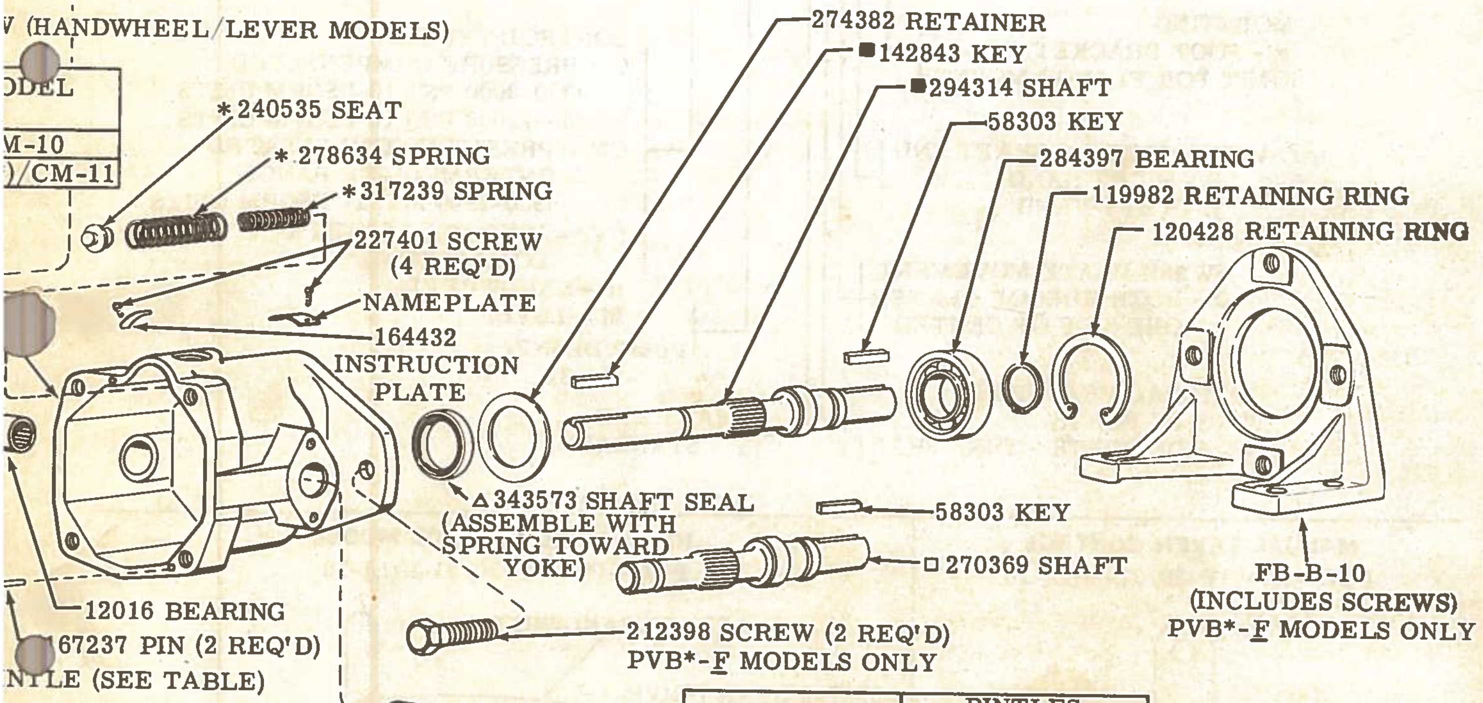


PLUG ASSEMBLY NOTE

MAKE CERTAIN 329465 PLUG O. D. AND MATING I. D. IN VALVE PLATE IS CLEAN. APPLY SEALING COMPOUND (LOCTITE GRADE "A" OR EQUIVALENT) TO PLUG O. D. AND PRESS PLUG INTO VALVE PLATE AS SHOWN.

CAUTION

DO NOT ALLOW SEALING COMPOUND TO CONTACT BEARING ROLLERS.



MODELS	PINTLES	
	CONTROL	OTHER
HANDWHEEL	269657	265425
LEVER	269658	
COMPENSATOR	265425	

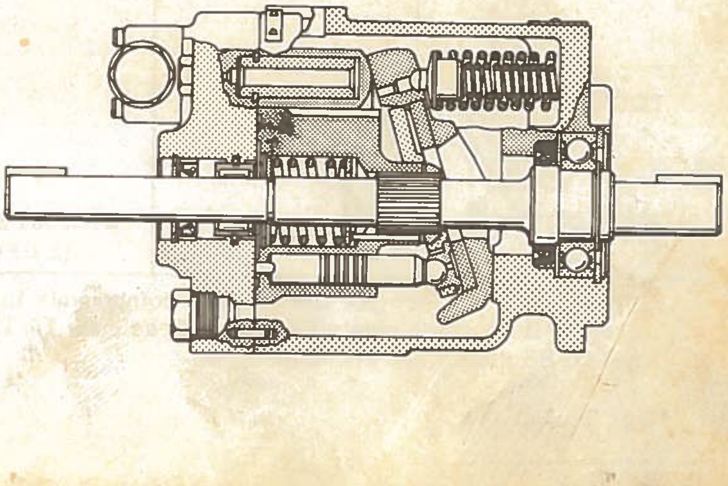
ASH LTE	ROTATING GROUP KIT
077	938276
	938273

◆PISTON SUBASSY KIT INCLUDES 9 PISTON AND SHOE S/A.

*USED ONLY ON COMPENSATOR MODELS

□USED ON PVB**-**WY-30/31-*(*)-1* SIDE PORT MODELS ONLY

■USED ON PVB**-**XY-30/31-*(*)-1* THRU SHAFT MODELS ONLY



MODEL CODE BREAKDOWN

PVB*-(*)*Y - 3* - *(*)(L)-1***

PUMP

VARIABLE DISPLACEMENT

IN-LINE PISTON UNIT

USGPM FLOW RATING AT 1800 RPM
10 - 10
15 - 15

MOUNTING
F - FOOT BRACKET
(OMIT FOR FLANGE MOUNT)

ROTATION, VIEWING SHAFT END
R - RIGHT HAND
L - LEFT HAND

SWASH PLATE MOVEMENT
D - BOTH SIDES OF CENTER
S - ONE SIDE OF CENTER

OPTIONAL FEATURES
W - SIDE PORTS
X - SIDE PORTS - THRU SHAFT

SHAFT END
Y - STANDARD

PUMP DESIGN
-30/-31

CONTROL TYPE
C - PRESSURE COMPENSATED
(350-3000 PSI) 10 USGPM UNITS
(350-2000 PSI) 15 USGPM UNITS
CM - PRESSURE COMPENSATED
(INTERMEDIATE RANGE)
(350-1500 PSI) 1* USGPM UNITS
CVP - PRESSURE LIMITER & LOAD SENSING
H - HANDWHEEL
M - LEVER

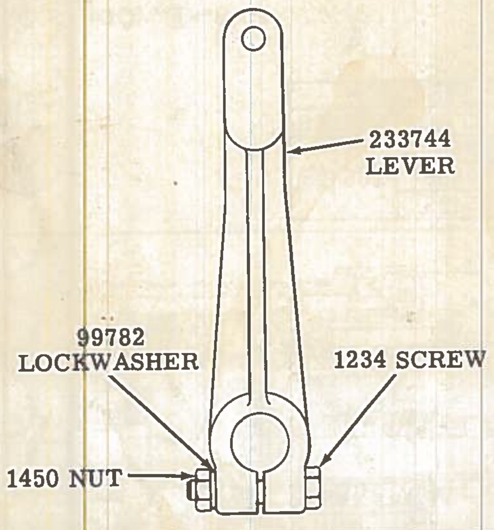
COMPENSATOR VARIATIONS
C - ADJUSTABLE MAXIMUM STOP

CONTROL OPTIONS
L - LEFT HAND LOCATION VIEWING SHAFT END
(OMIT FOR RIGHT HAND LOCATION)

CONTROL DESIGN NUMBER

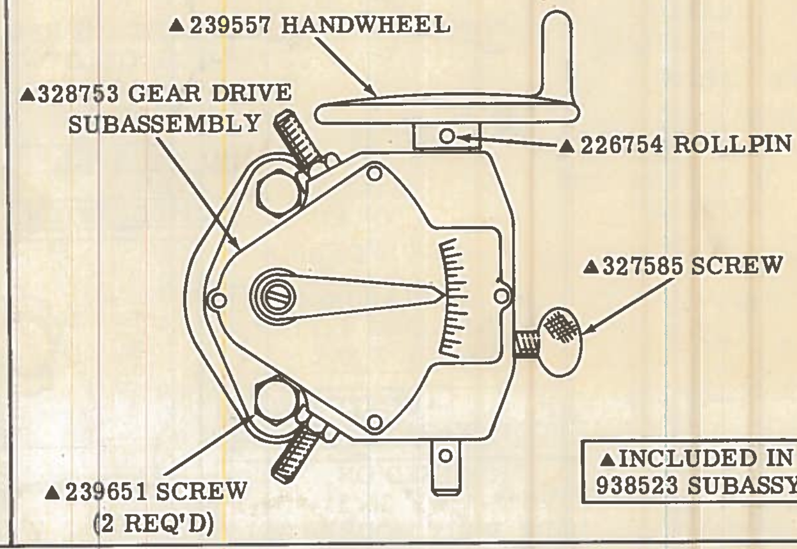
MANUAL LEVER CONTROL

PVB*-(*)***Y-30/31-M(L)-10



HANDWHEEL CONTROL MODEL

PVB*-(*)***Y-30/31-H(L)-10



▲INCLUDED IN
938523 SUBASSY

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U. S. A.

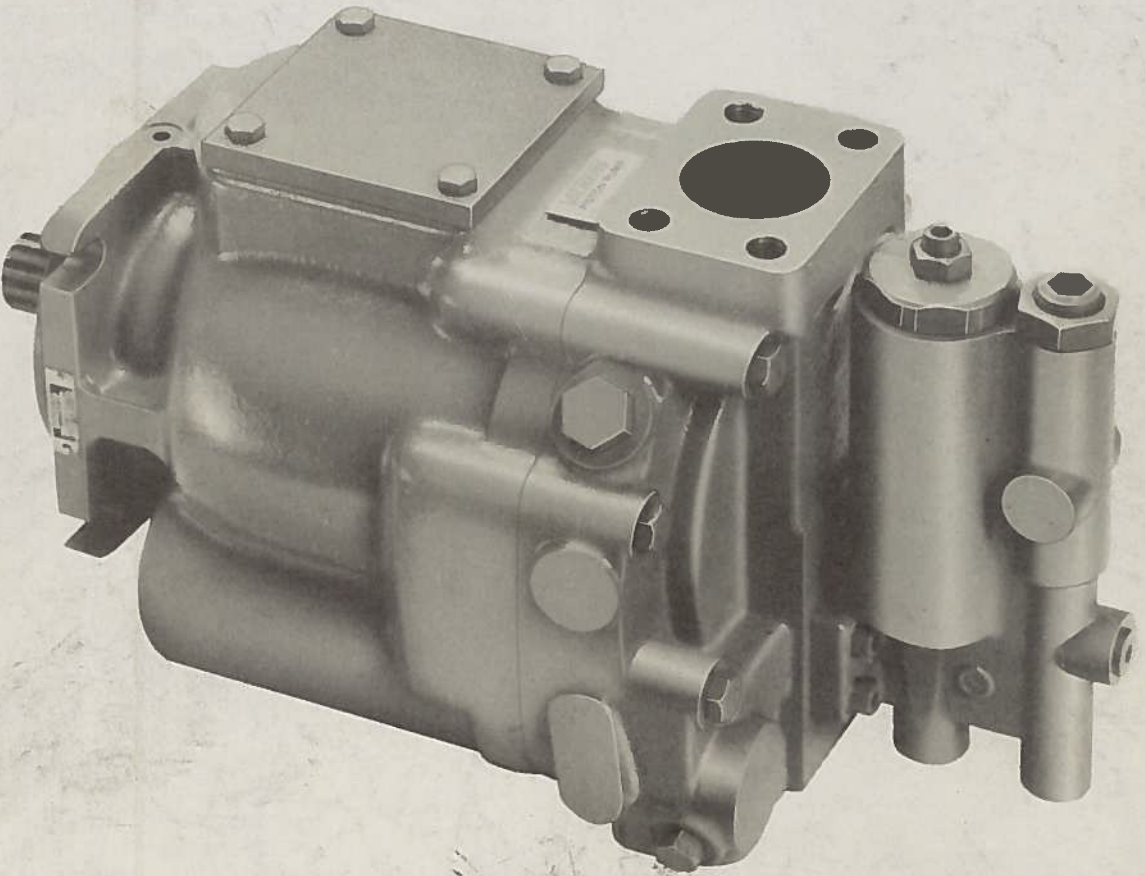
VICKERS

Service Parts Information

HEAVY DUTY PISTON PUMP STANDARD/ THRU DRIVE

PVE62QI*-**-(M)(D)-21-C(*)V-21

3



Vickers, Incorporated

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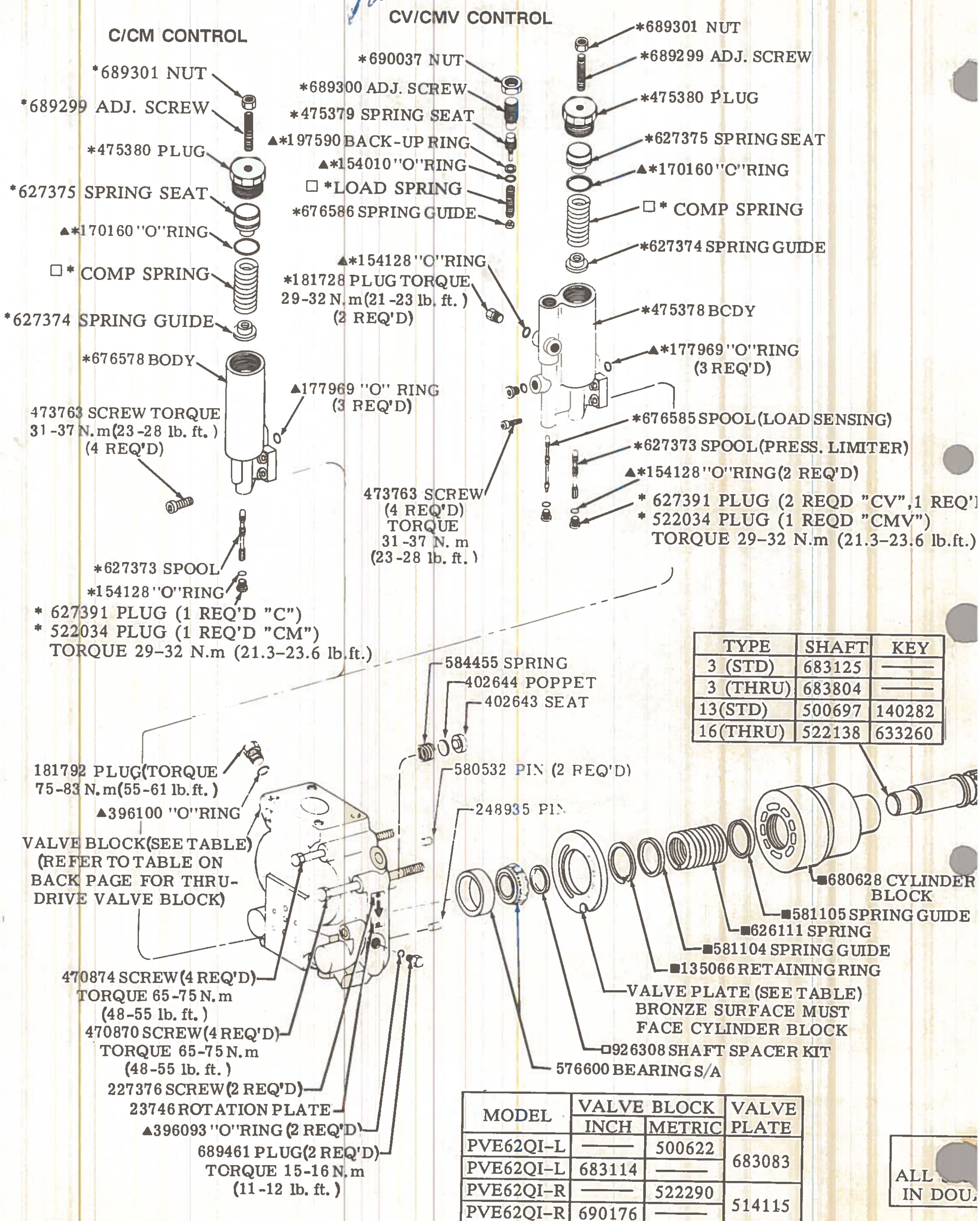
Released 8-1-88 **M-2238-S**

New


C/CM CONTROL
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O"RING
☐* COMP SPRING
*627374 SPRING GUIDE
*676578 BODY
473763 SCREW TORQUE 31-37 N.m(23-28 lb. ft.) (4 REQ'D)
▲177969 "O" RING (3 REQ'D)
*627373 SPOOL
*154128 "O"RING
* 627391 PLUG (1 REQ'D "C")
* 522034 PLUG (1 REQ'D "CM")
TORQUE 29-32 N.m (21.3-23.6 lb.ft.)
CV/CMV CONTROL
*690037 NUT
*689300 ADJ. SCREW
*475379 SPRING SEAT
▲*197590 BACK-UP RING
▲*154010 "O"RING
☐ *LOAD SPRING
*676586 SPRING GUIDE
▲*154128 "O"RING
*181728 PLUG TORQUE 29-32 N.m(21-23 lb. ft.) (2 REQ'D)
473763 SCREW (4 REQ'D) TORQUE 31-37 N.m (23-28 lb. ft.)
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "C"RING
☐* COMP SPRING
*627374 SPRING GUIDE
*475378 BODY
▲*177969 "O"RING (3 REQ'D)
*676585 SPOOL (LOAD SENSING)
*627373 SPOOL (PRESS. LIMITER)
▲*154128 "O"RING (2 REQ'D)
* 627391 PLUG (2 REQD "CV",1 REQ'
* 522034 PLUG (1 REQD "CMV")
TORQUE 29-32 N.m (21.3-23.6 lb.ft.)
584455 SPRING
402644 POPPET
402643 SEAT
580532 PIN (2 REQ'D)
248935 PIN
181792 PLUG(TORQUE 75-83 N.m(55-61 lb.ft.)
▲396100 "O"RING
VALVE BLOCK(SEE TABLE) (REFER TO TABLE ON BACK PAGE FOR THRU-DRIVE VALVE BLOCK)
470874 SCREW(4 REQ'D) TORQUE 65-75 N.m (48-55 lb. ft.)
470870 SCREW(4 REQ'D) TORQUE 65-75 N.m (48-55 lb. ft.)
227376 SCREW(2 REQ'D)
23746 ROTATION PLATE
▲396093 "O"RING (2 REQ'D)
689461 PLUG(2 REQ'D) TORQUE 15-16 N.m (11-12 lb. ft.)
■680628 CYLINDER BLOCK
■581105 SPRING GUIDE
■626111 SPRING
■581104 SPRING GUIDE
■135066 RETAINING RING
VALVE PLATE (SEE TABLE) BRONZE SURFACE MUST FACE CYLINDER BLOCK
☐926308 SHAFT SPACER KIT
576600 BEARING S/A

TYPE	SHAFT	KEY
3 (STD)	683125	———
3 (THRU)	683804	———
13(STD)	500697	140282
16(THRU)	522138	633260

MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE62QI-L	———	500622	683083
PVE62QI-L	683114	———	
PVE62QI-R	———	522290	514115
PVE62QI-R	690176	———	

ALL
IN DOU

3

VICKERS

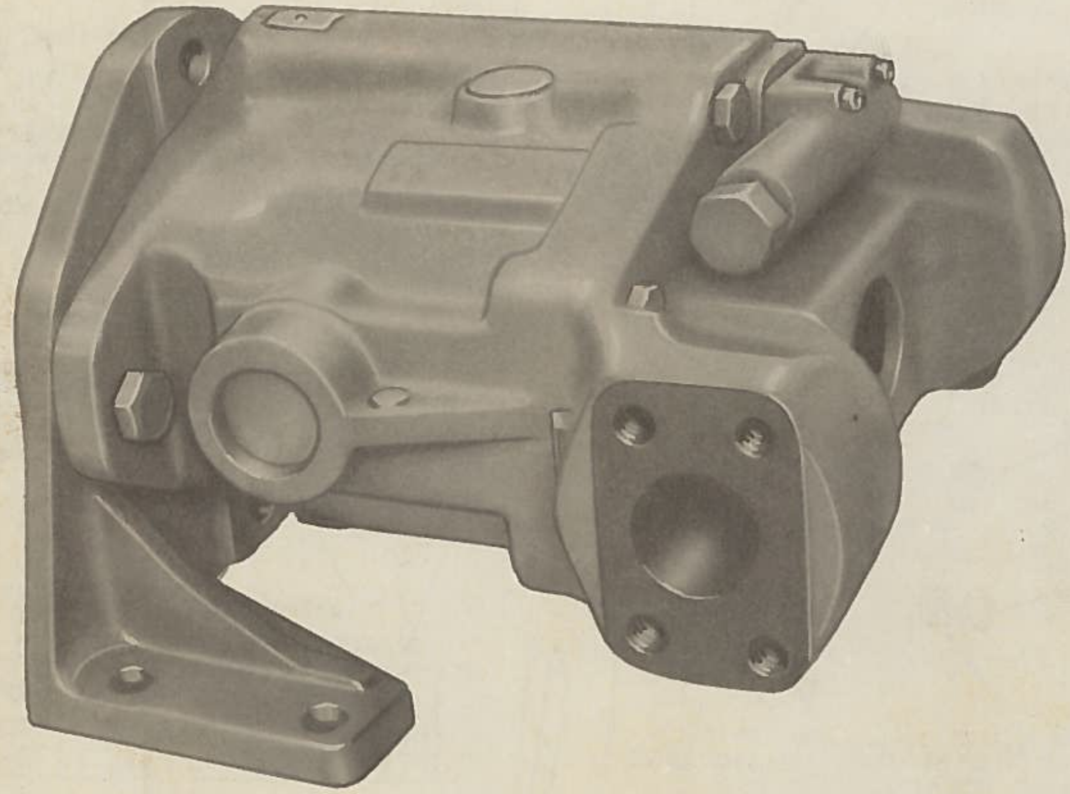
Service Parts Information

20 & 29 GPM Variable Thru Shaft, Side Ported, Inline Piston Pumps

PVB20-(F)*SFW-20-C(M)-11
PVB20-(F)*SFX-20-C(M)-11
PVB29-(F)*SFW-20-C(M)-11
PVB29-(F)*SFX-20-C(M)-11

②

20



Vickers, Incorporated

1401 Crooks Road
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Revised 10-1-85

I-3293-S

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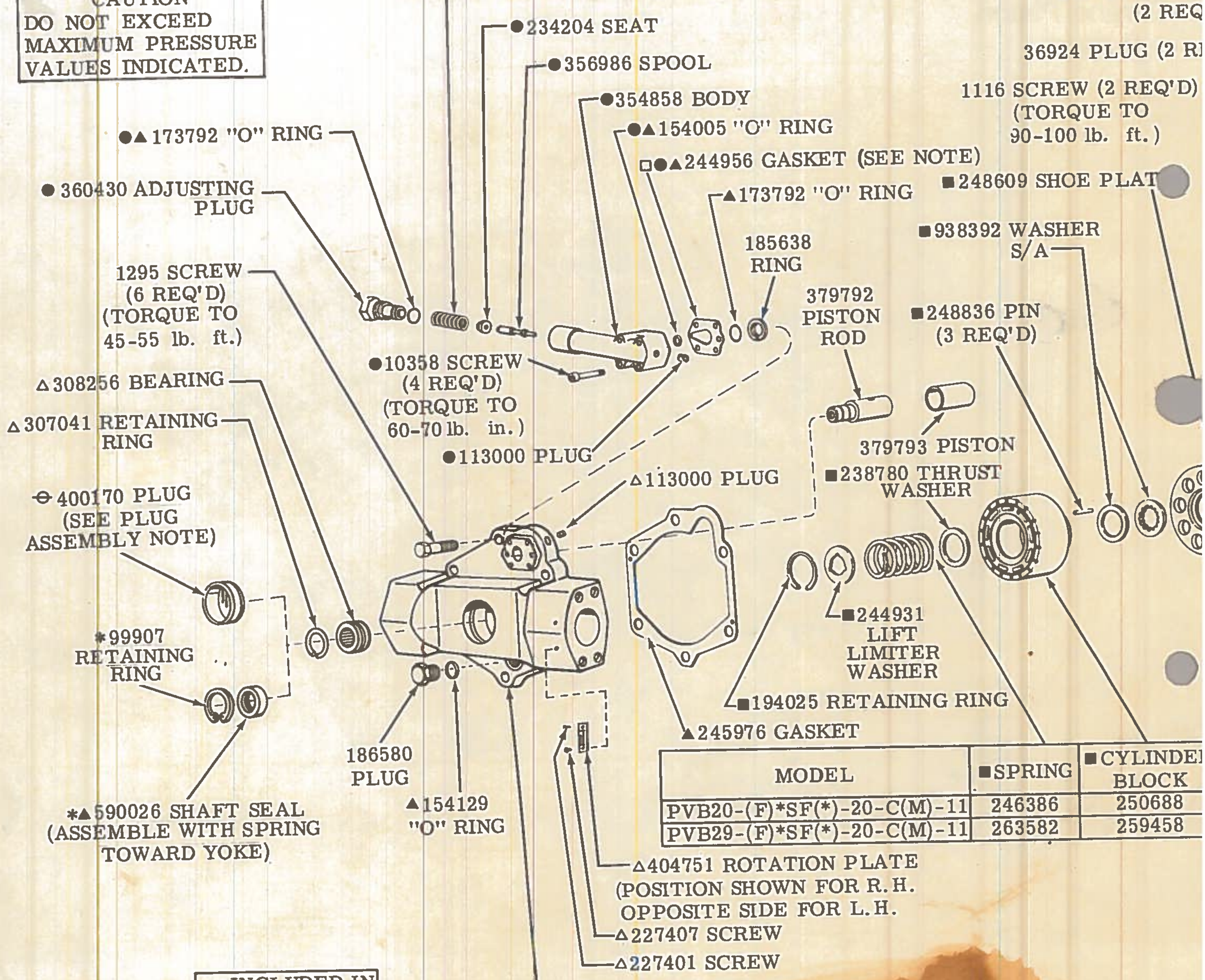
105

● INCLUDED IN PRESSURE COMPENSATOR SUBASSYS SHOWN IN TABLE.

PRESSURE RANGE (PSI)	COMPENSATOR SUBASSY	● SPRING
(C) 250-2500 (20) 250-2000 (29)	942158	239371
(CM) 250-1500	942159	265693

CAUTION
DO NOT EXCEED MAXIMUM PRESSURE VALUES INDICATED.

□ NOTE
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJ. PLUG.



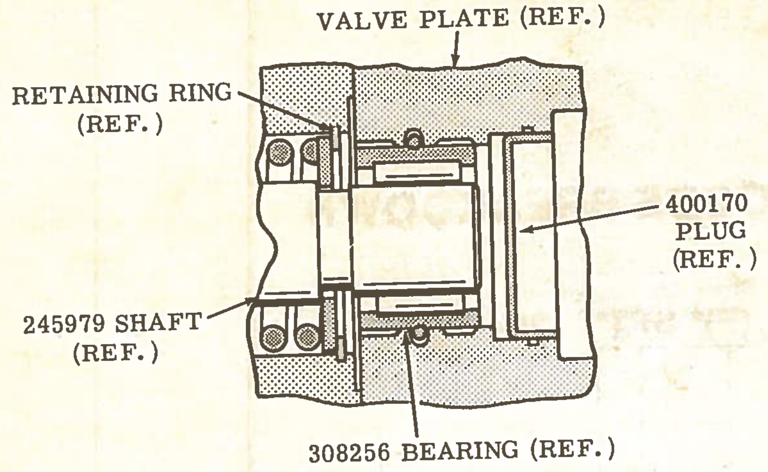
MODEL	■ SPRING	■ CYLINDE BLOCK
PVB20-(F)*SF(*)-20-C(M)-11	246386	250688
PVB29-(F)*SF(*)-20-C(M)-11	263582	259458

▲ INCLUDED IN 919498 SEAL KIT

919847 F3 SEAL KIT FOR PVB20/29-*SFX-20-C**-11

920305 F3 SEAL KIT FOR PVB20/29-*SFW-20-C**-11

△ INCLUDED IN VALVE PLATE S/A	MODEL
942241	PVB20-(F)RSF(*)-20-C(M)-11
942242	PVB20-(F)LSF(*)-20-C(M)-11
942243	PVB29-(F)RSF(*)-20-C(M)-11
942244	PVB29-(F)LSF(*)-20-C(M)-11

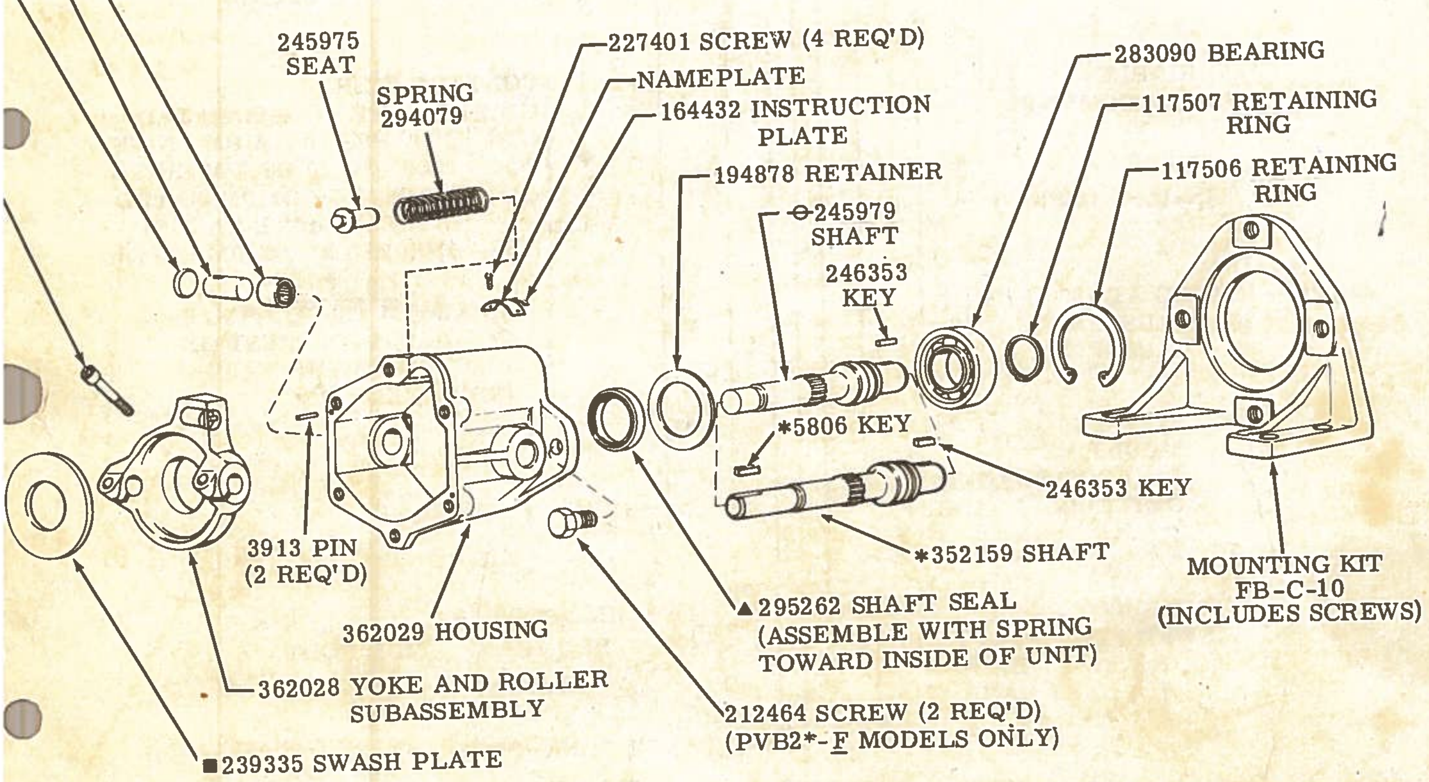


PLUG ASSEMBLY NOTE

MAKE CERTAIN 400170 PLUG O. D. AND MATING I. D. IN VALVE PLATE IS CLEAN. APPLY SEALING COMPOUND (LOCTITE GRADE "A" OR EQUIVALENT) TO PLUG O. D. AND PRESS PLUG INTO VALVE PLATE AS SHOWN.

CAUTION

DO NOT ALLOW SEALING COMPOUND TO CONTACT BEARING ROLLERS.

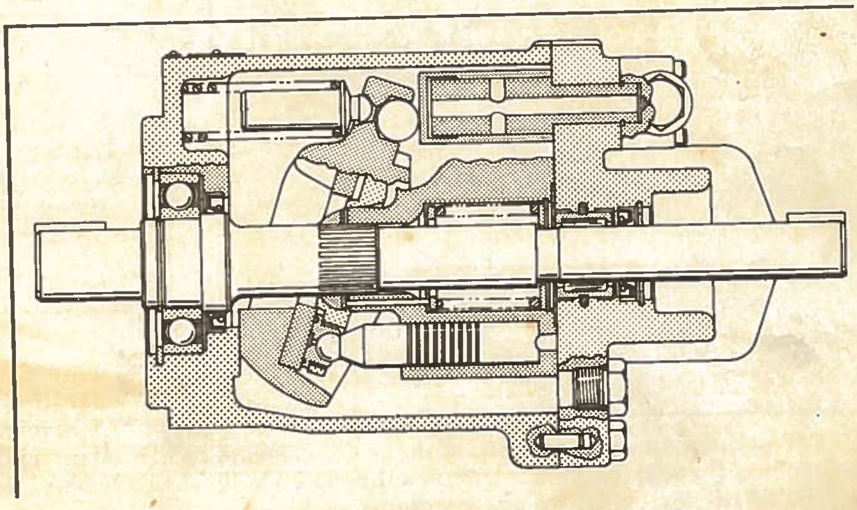


ON IT	ROTATING GROUP
3	938274
8	938275

■ INCLUDED IN ROTATING GROUP

⊖ USED ON PVB2*-(F)*SFW-20-C(M)-11 SIDE PORT MODELS ONLY

* USED ON PVB2*-(F)*SFX-20-C(M)-11 THRU SHAFT MODELS ONLY



MODEL CODE BREAKDOWN

PVB 2* -(F)* SF (*) -20- *(*)- 11

PUMP

VARIABLE
DISPLACEMENT

IN-LINE DESIGN

USGPM - RATING AT 1800 RPM
20 - 20 USGPM
29 - 29 USGPM

MOUNTING
F - FOOT BRACKET
OMITTED - FLANGE

ROTATION
(VIEWED FROM SHAFT END)
R - RIGHT HAND
L - LEFT HAND

DISPLACEMENT
S - SWASH PLATE MOVEMENT
ONE SIDE OF CENTER

FLANGE CONNECTED

W – SIDE PORT
X – THRU SHAFT - SIDE PORT

PUMP DESIGN

CONTROL TYPE
C - PRESSURE COMPENSATED
(250 - 3000 PSI) 20 USGPM UNITS
(250 - 2000 PSI) 29 USGPM UNITS
CM - PRESSURE COMPENSATED
(INTERMEDIATE RANGE)
(250 - 1500 PSI) 2* USGPM UNITS

CAUTION

MAXIMUM PSI SETTING OF COMPENSATOR MUST BE LIMITED TO THE VALUES INDICATED.

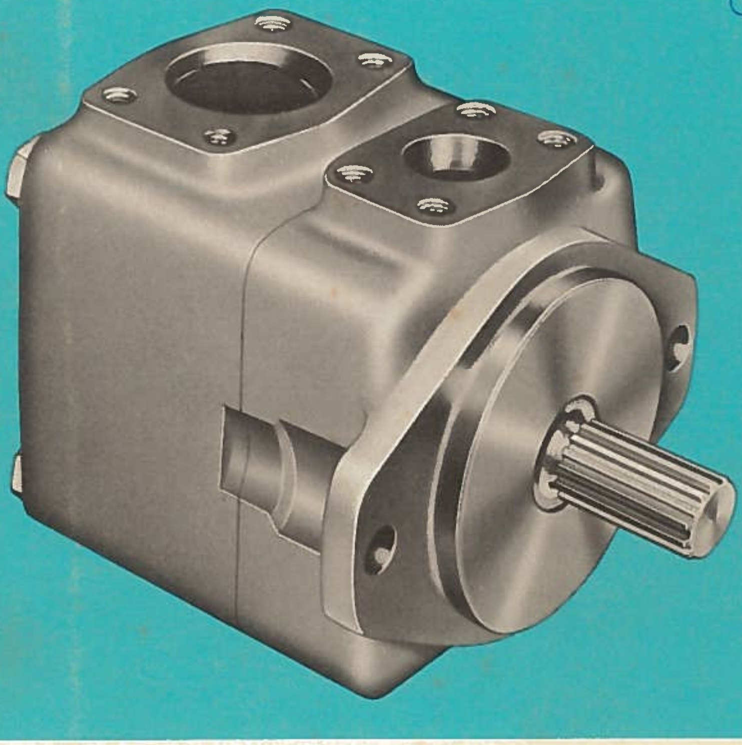
CONTROL DESIGN

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series filters are recommended.

Litho in U.S.A.

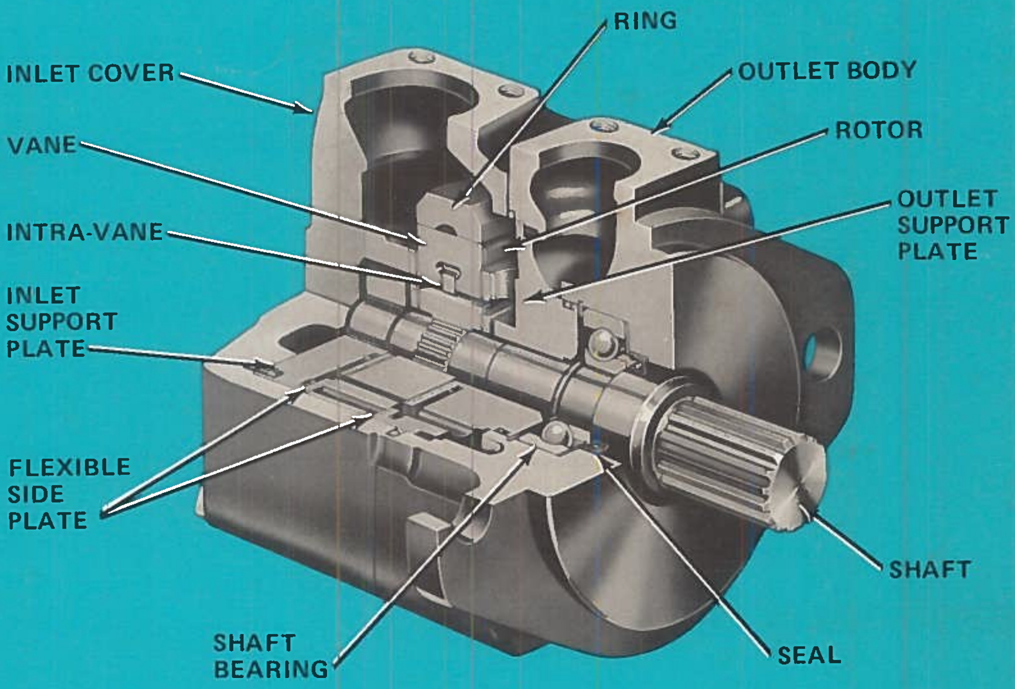
VQ Vane Pumps for Mobile Applications

①



- Single Pumps — 11 sizes, deliveries to 60 gpm at 1200 rpm and 100 psi
- Double Pumps — 95 flow combinations, deliveries to 98 gpm at 1200 rpm and 100 psi
- Maximum speeds and pressures to 2700 rpm and 3000 psi, depending on pump size

SPERRY VICKERS



New Design Features

Fluid flow is developed in a new pump cartridge which consists principally of a cam ring, rotor, ten vanes, and unique new side plates and support plates. The bimetallic flexible side plates are located on each side of the rotor with their bronze face toward the rotor and their steel face toward the support plate. Two cavities in each support plate hold high pressure oil against the flexible side plate, thereby hydrostatically balancing the flexible plate and providing optimum clearance with the rotor.

Hydraulically Balanced For Long Life

Pump inlet and outlet pressure ports are diametrically opposed as shown in Figure 1. As a result, the rotor is hydraulically balanced. Bearings thus encounter no hydraulic loads, assuring long life.

Figure 2 shows an insert fitted into a slot in the vane. Outlet pressure is applied continuously only to the space between the vane and insert. Top and bottom areas of the vane are subject to either inlet or outlet pressure, depending upon the vane's location during rotor rotation. See Figure 1. Complete hydraulic balance is effected in the outlet pressure areas. Outward thrust by the vane in the inlet area is equal to the outlet pressure times the projected area of the end of the insert.

More Reliable and Efficient

Axial and radial running clearances, along with lubricating oil film on the rotor and vanes, are optimized over the entire operating pressure range. Excellent cold-start capability and superior resistance to seizure make Sperry Vickers' new VQ pumps highly reliable, and volumetric efficiency is 2 to 4% greater compared to the previous design.

Easily Interchanges With Previous Design

The new VQ cartridge or pump is totally interchangeable with the previous design and, without modification, can be used with petroleum oil or water glycol fluids. The cartridge is easy to service and can normally be replaced in ten minutes or less without removing the pump from its mounting. A small stock of cartridges can serve many pump models on a variety of vehicles.

Optimum Installation Flexibility

Pump ports can be located in any of several positions to facilitate installation. Porting arrangements are described in the model codes on pages 4 and 12. Should installation requirements change, the ports can be easily repositioned.

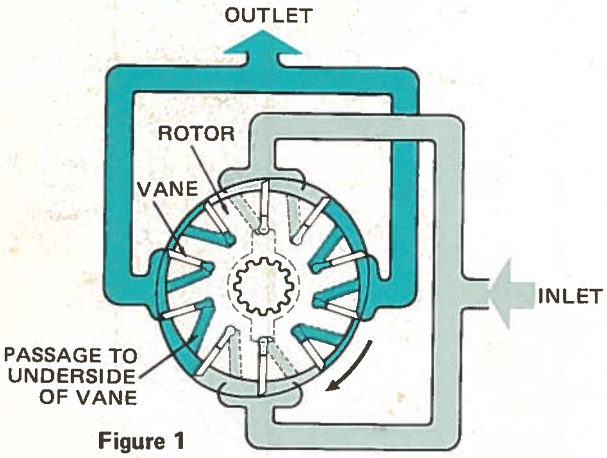


Figure 1

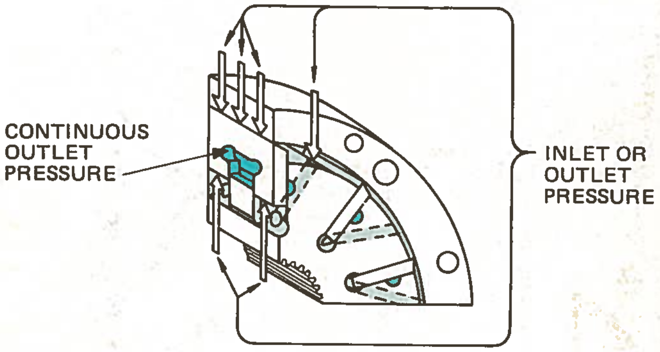


Figure 2

Index

PAGE

SINGLE PUMPS

Specifications and Model Code 4
Dimensions. 5-7
Performance and Speed Correction Curves. 8-10

DOUBLE PUMPS

Specifications. 11
Model Code. 12
Dimensions. 13-17
Performance Curves, Shaft-End Pumps. 18-20
Cover-End Pumps. 21-25
Speed Correction Curves. 26

PORT CONNECTION FLANGES, SAE 4-BOLT. 27

Single Pump Specifications

MODEL SERIES	DELIVERY GPM AT 1200 RPM 100 PSI	DISPL. CU. IN./REV.	MAX. RPM	MAX. PSI	TYPICAL DEL. GPM AT MAX. SPEED & PRESSURE	TYPICAL INPUT HP AT MAX. SPEED & PRESSURE	WEIGHT LBS.
25VQ	12 14 17 21	2.45 2.77 3.37 4.12	2700 2700 2500 2500	3000	23 27 31 38	55 62.5 69.5 83	32
35VQ	25 30 35 38	4.98 5.96 6.88 7.42	2500 2500 2400 2400	3000	45 55 60 65	101 117.5 132 140	50
45VQ	42 50 60	8.46 9.90 11.80	2200 2200 2200	2500	66.5 79 96	122.5 141 170	75

Performance Constants: SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

Note: Outlet pressure must always be higher than inlet pressure.

Model Code

F3 – 25 VQ 21 A * – 11 C 20 L

VITON SEALS
(OMIT IF NOT REQUIRED)

SERIES DESIGNATION
25VQ, 35VQ, 45VQ } STANDARD BEARING
26VQ, 36VQ } HEAVY DUTY BEARING

FLEX PLATE VANE TYPE PUMP

SAE RATED CAPACITY — GPM
(1200 RPM - 100 PSI)
25VQ - 12, 14, 17 & 21
35VQ - 25, 30, 35 & 38
45VQ - 42, 50 & 60

SAE PORT CONNECTIONS

SERIES	CODE	INLET	OUTLET
ALL	A	4-BOLT	4-BOLT
25VQ	B	STR. THD.	STR. THD.
25VQ	C	4-BOLT	STR. THD.
25VQ	D	STR. THD.	4-BOLT

MOUNTING & SHAFT SEAL ASSEMBLY
F - FOOT MOUNT & SINGLE SHAFT SEAL
S - FLANGE MOUNT & DOUBLE SHAFT SEAL
(OMIT FOR FLANGE MOUNT & SINGLE SHAFT SEAL)

SHAFT ROTATION
(VIEWED FROM SHAFT END)
L - LEFT HAND (OMIT FOR RIGHT HAND)

DESIGN NUMBER
DESIGN NUMBERS SUBJECT TO CHANGE. INSTALLATION DIMENSIONS REMAIN THE SAME FOR DESIGN NUMBERS 20 THRU 29.

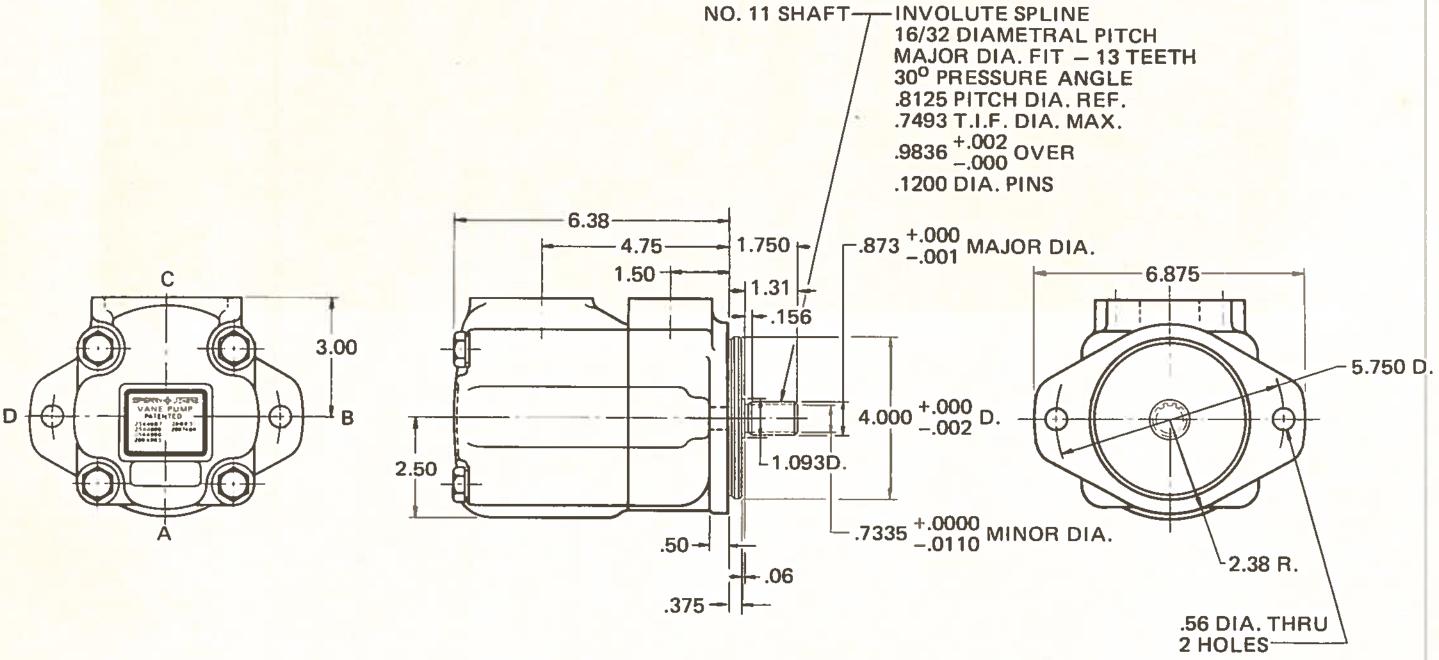
INLET POSITION VIEWED FROM COVER END
A - OPPOSITE OUTLET
B - 90° CLOCKWISE FROM OUTLET
C - INLINE WITH OUTLET
D - 90° COUNTERCLOCKWISE FROM OUTLET

SHAFTS

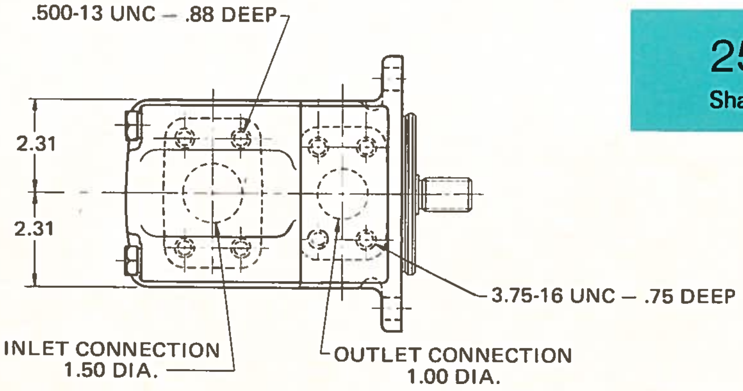
SINGLE SHAFT SEAL PUMPS
1 - STRAIGHT KEY
3 - THREADED (25VQ ONLY)
4 - SPLINED (45VQ ONLY)
6 - WOODRUFF KEY (25VQ ONLY)
11 - SPLINED

DOUBLE SHAFT SEAL PUMPS
110 - SPLINED (SAME AS NO. 4)
123 - SPLINED (SAME AS NO. 11). NOT AVAILABLE ON 45VQ.
130 - SPLINED (SAME AS NO. 11). 45VQ ONLY.

Installation Dimensions



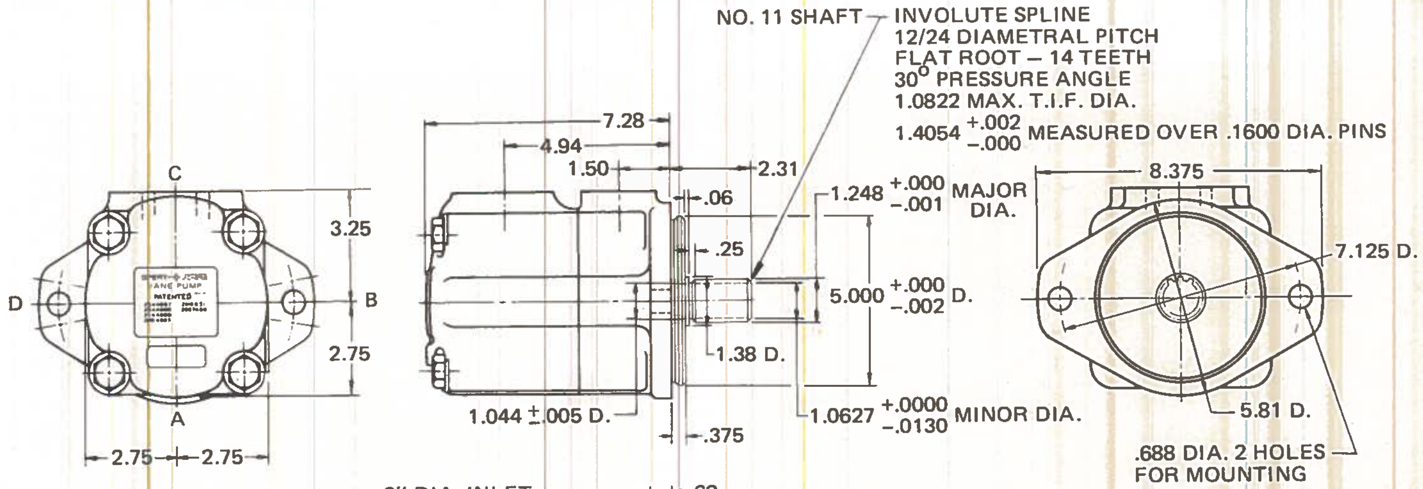
RT CONNECTION PADS ARE FOR USE WITH SAE 4-BOLT FLANGES.

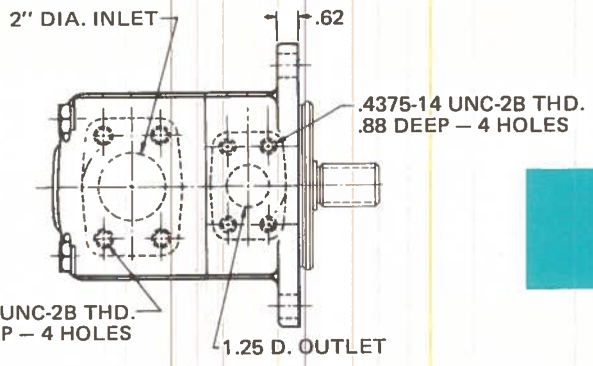


25VQ series

Shaft options shown on page 7.

Installation Dimensions (cont.)

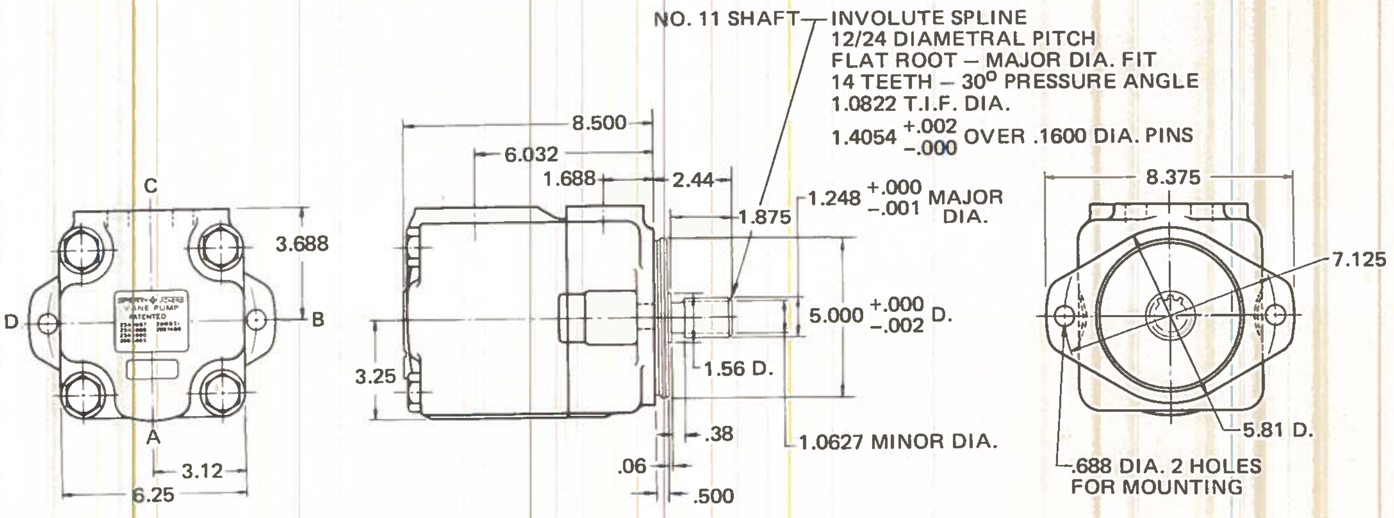


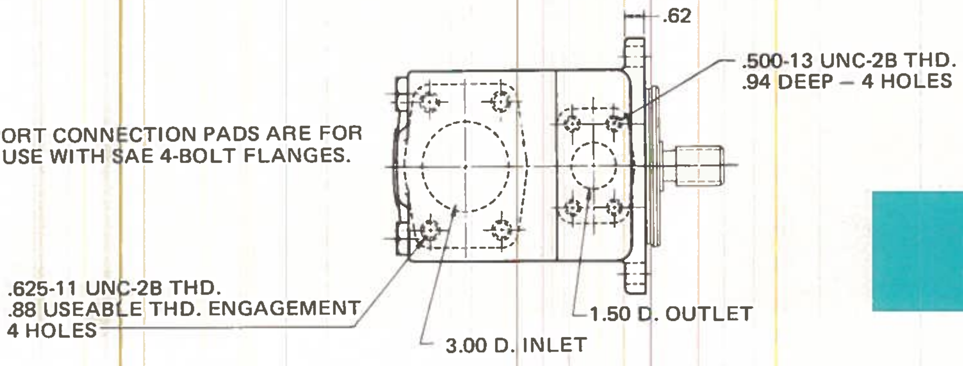


PORT CONNECTION PADS ARE FOR USE WITH SAE 4-BOLT FLANGES.

35VQ series

Shaft options shown on page 7.





PORT CONNECTION PADS ARE FOR USE WITH SAE 4-BOLT FLANGES.

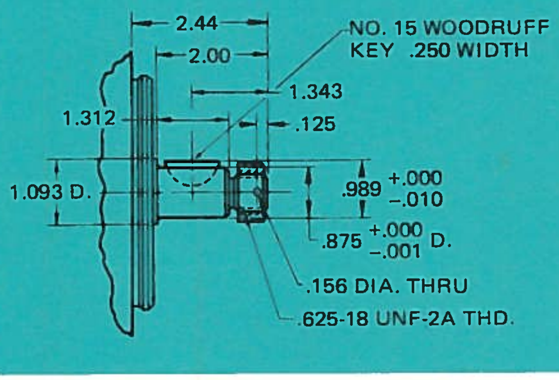
45VQ series

Shaft options shown on page 7.

Optional Shafts

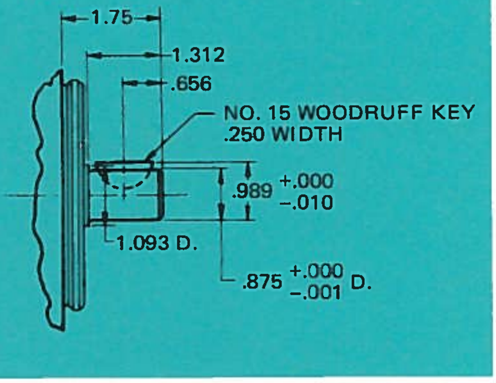
SERIES 25VQ

NO. 3 THREADED SHAFT



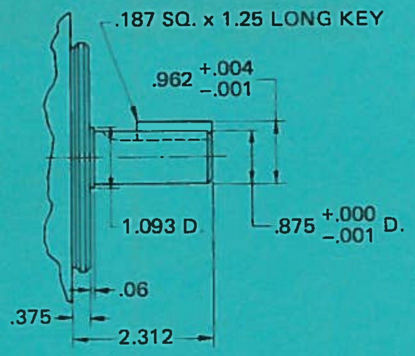
SERIES 25VQ

NO. 6 STRAIGHT STUB SHAFT



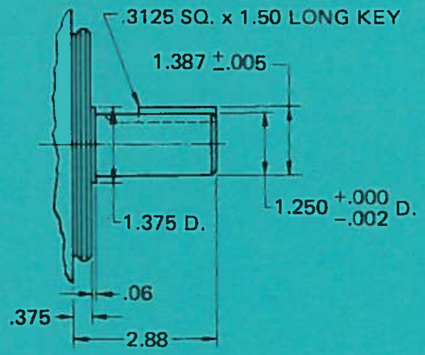
SERIES 25VQ

NO. 1 STRAIGHT KEY SHAFT



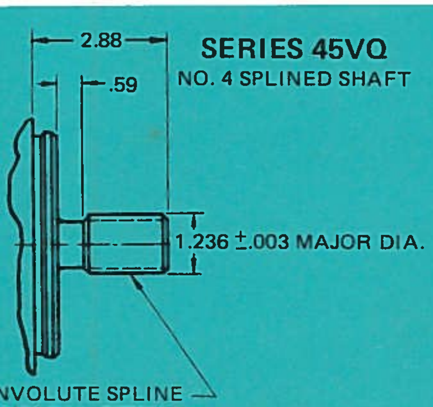
SERIES 35VQ

NO. 1 STRAIGHT KEY SHAFT



SERIES 45VQ

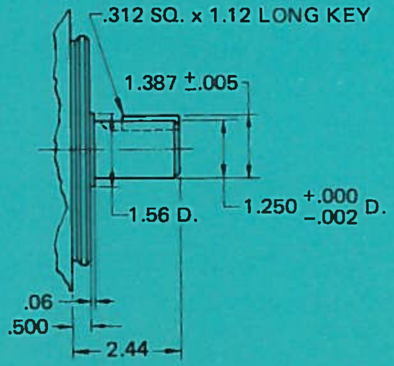
NO. 4 SPLINED SHAFT



INVOLUTE SPLINE
12/24 DIA. PITCH
14 TEETH – 30° PRESSURE ANGLE
1.4067 ±.0007 OVER .1600 D. PINS
1.056 ±.007 MINOR DIA.

SERIES 45VQ

NO. 1 STRAIGHT KEY SHAFT



Typical Performance

25VQ Single Pumps

Performance Constants:

SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

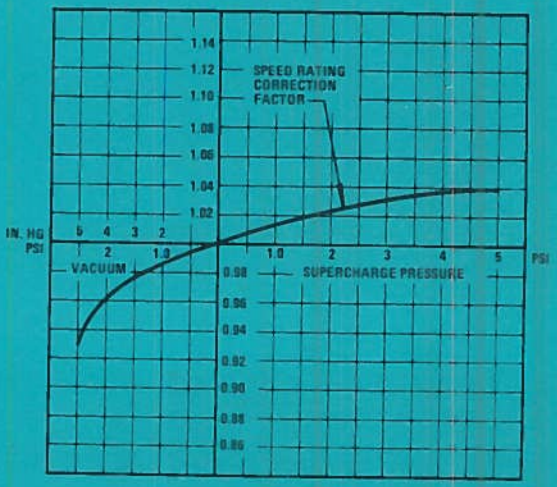
MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR.

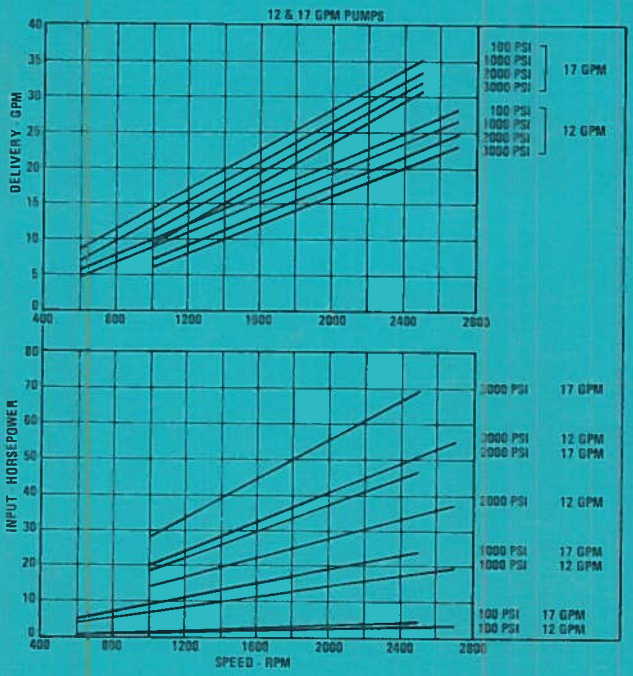
EXAMPLE:

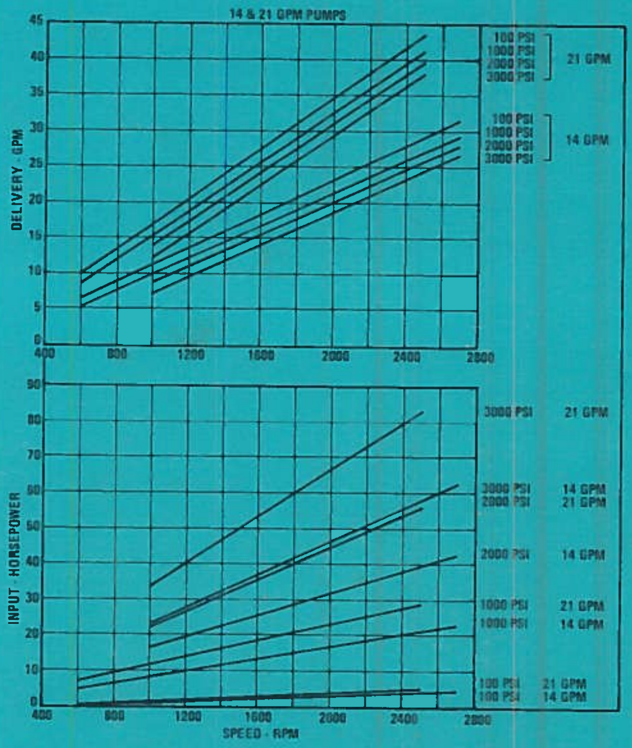
MAX. SPEED @ 0 PSI INLET	2700 RPM
CORRECTION FACTOR @ 5 IN. HG.	x .93
MAX. SPEED @ 5 IN. HG. INLET	2511 RPM

PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

MAXIMUM OPERATING SPEED CORRECTION FACTORS BASED ON PUMP INLET CONDITIONS







35VQ Single Pumps

Performance Constants:

SAE 10W fluid @ 180°F.
Pump inlet @ 0 PSIG (14.7 PSIA)

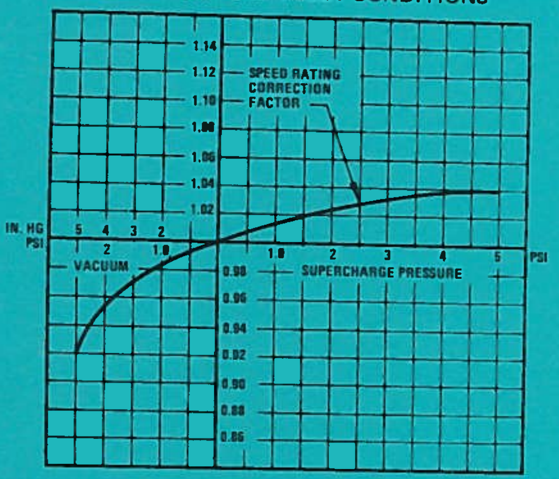
MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR.

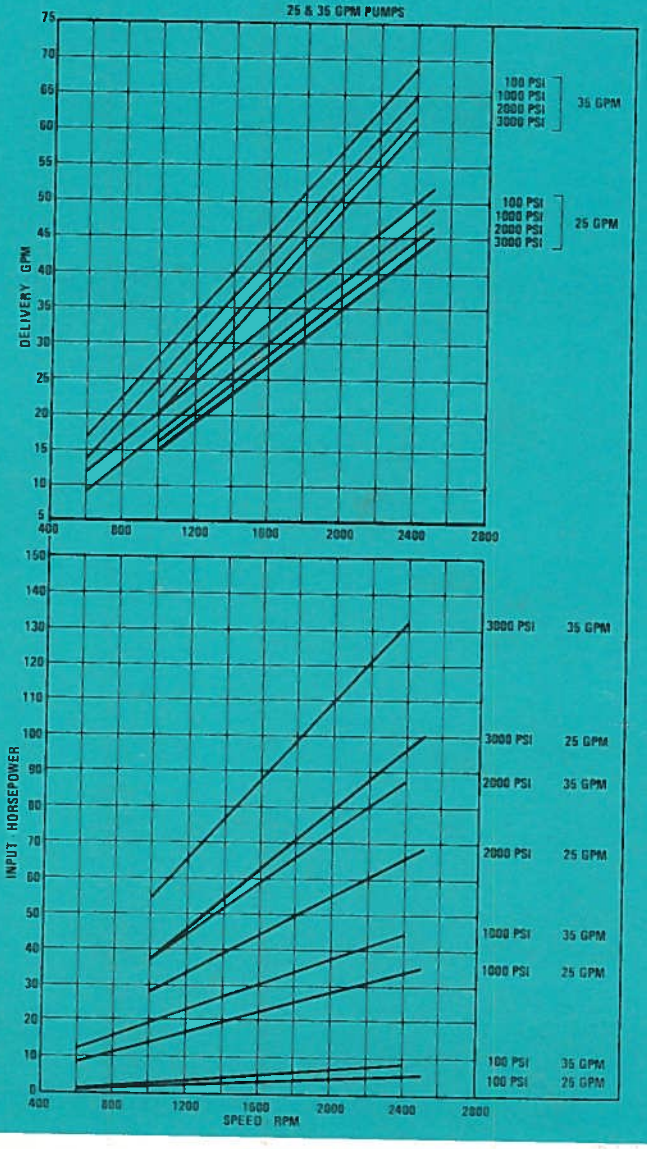
EXAMPLE:

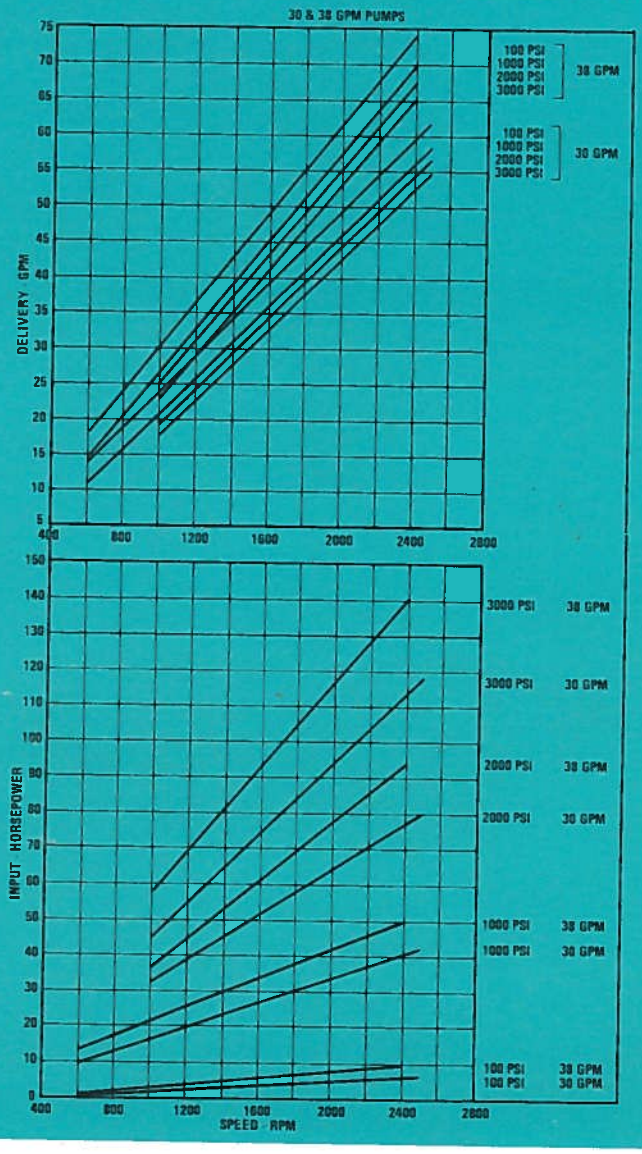
MAX. SPEED @ 0 PSI INLET	2500 RPM
CORRECTION FACTOR @ 5 IN. HG.	x .92
MAX. SPEED @ 5 IN. HG. INLET	2300 RPM

PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

MAXIMUM OPERATING SPEED CORRECTION FACTORS BASED ON PUMP INLET CONDITIONS







Typical Performance (cont.)

45VQ Single Pumps

Performance Constants: SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

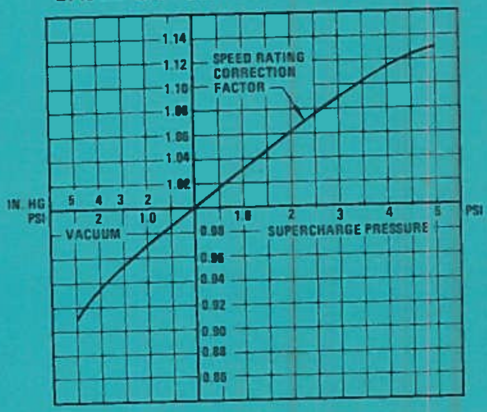
MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR.

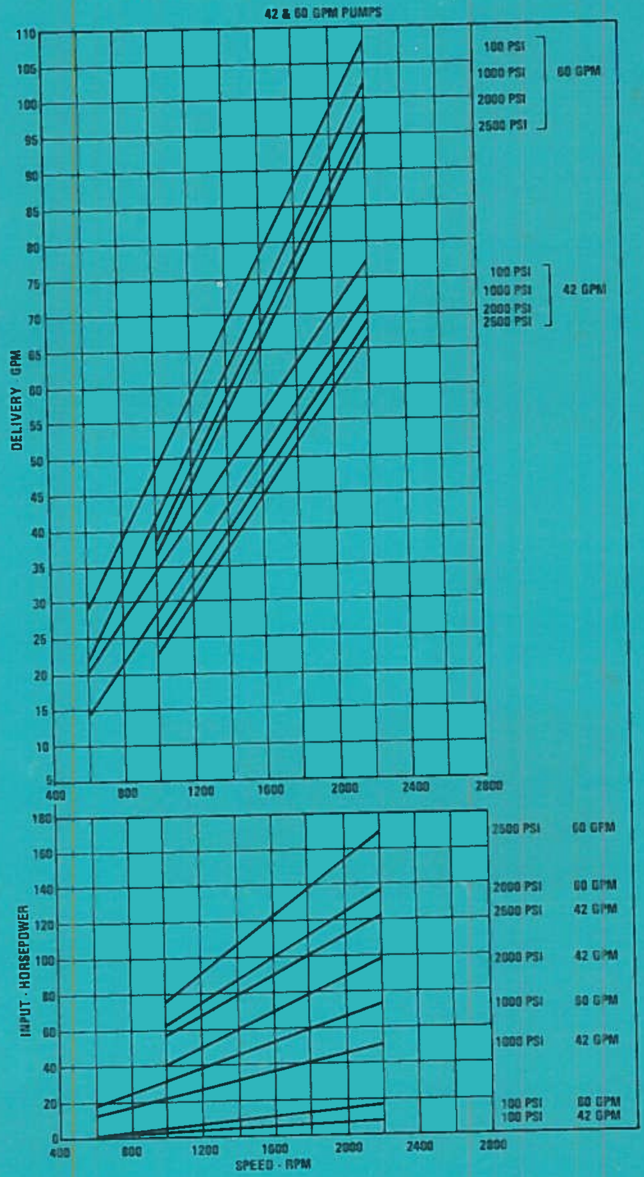
EXAMPLE:

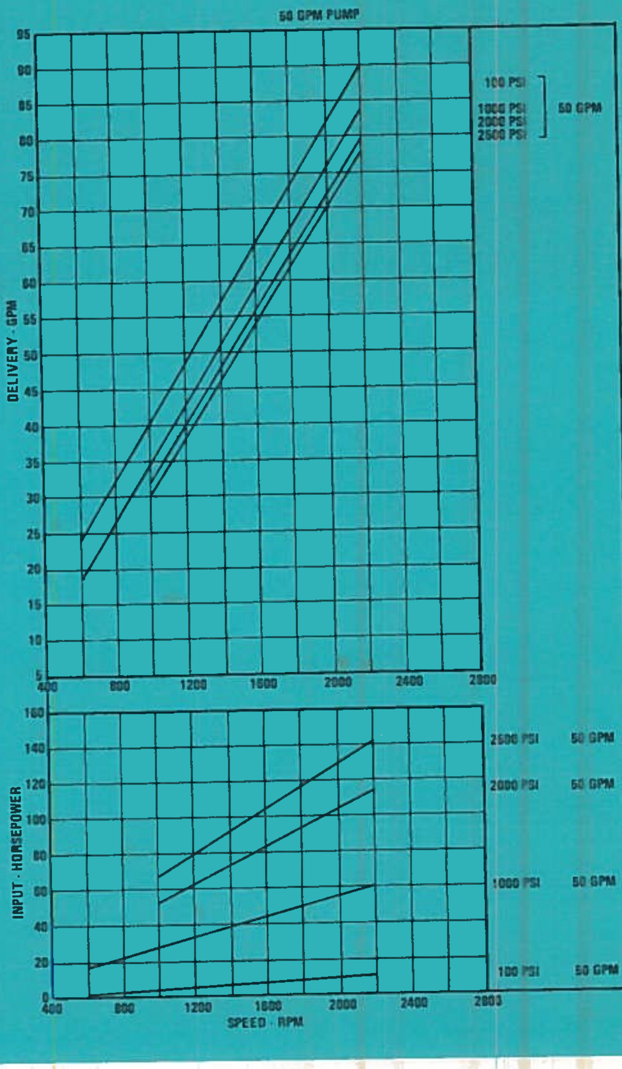
MAX. SPEED @ 0 PSI INLET	2200 RPM
CORRECTION FACTOR @ 5 IN. HG.	x .91
MAX. SPEED @ 5 IN. HG. INLET	2002 RPM

PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

MAXIMUM OPERATING SPEED CORRECTION FACTORS BASED ON PUMP INLET CONDITIONS







Double Pump Specifications

	SHAFT END PUMP						COVER END PUMP						
MODEL SERIES	DELIVERY GPM AT 1200 RPM 100 PSI	DISPL. CU. IN./REV.	MAX. RPM	MAX. PSI	TYPICAL DEL. GPM AT MAX. SPEED & PRESSURE	TYPICAL INPUT HP AT MAX. SPEED & PRESSURE	DELIVERY GPM AT 1200 RPM 100 PSI	DISPL. CU. IN./REV.	MAX. RPM	MAX. PSI	TYPICAL DEL. GPM AT MAX. SPEED & PRESSURE	TYPICAL INPUT HP AT MAX. SPEED & PRESSURE	WEIGHT LBS.
2520VQ	12 14 17 21	2.45 2.76 3.37 4.12	2700 2700 2500 2500	3000	23 27 31 38	55 62.5 69.5 83	5 8 11 12 14	1.10 1.67 2.22 2.41 2.80	2700	3000 3000 3000 2300 2000	11 17 23 25.5 30	24 35 47.5 38 39	45
3520VQ	25 30 35 38	4.98 5.96 6.88 7.42	2500 2500 2400 2400	3000	45 55 60 65	101 117.5 132 140	5 8 11 12 14	1.10 1.67 2.22 2.41 2.80	2500	3000 3000 3000 2300 2000	10 16 21 23.5 27.5	22 32.5 44 35 36	75
3525VQ	25 30 35 38	4.98 5.96 6.88 7.42	2500 2500 2400 2400	3000	45 55 60 65	101 117.5 132 140	12 14 17 21	2.45 2.76 3.37 4.12	2500	3000	21 24 31 38	51 58 69 83	76
4520VQ	42 50 60	8.46 9.90 11.80	2200	2500	66.5 79 96	122.5 141 170	5 8 11 12 14	1.10 1.67 2.22 2.41 2.80	2200	3000 3000 3000 2300 2000	8.5 13.5 18 20.5 24	19.5 28.5 38.5 31 32	94
4525VQ	42 50 60	8.46 9.90 11.80	2200	2500	66.5 79 96	122.5 141 170	12 14 17 21	2.45 2.76 3.37 4.12	2200	3000	18 21 26.5 33	44 51 61 73	101
4535VQ	42 50 60	8.46 9.90 11.80	2200	2500	66.5 79 96	122.5 141 170	25 30 35 38	4.98 5.96 6.88 7.42	2200	3000	38.5 47 55 59	89 104 120 130	118

Performance Constants: SAE 10W fluid @ 180° F.
Pump inlet @ O PSIG (14.7 PSIA)

Note: Outlet pressure must always be higher than inlet pressure.

MAXIMUM SHAFT TORQUE RATING
BASED ON TORSIONAL FATIGUE ALONE

MODEL SERIES	TORQUE (LB. IN.) FOR SHAFT TYPE	
	STRAIGHT KEYED	SPLINED
2520VQ*	NO. 1 - 2800	NO. 11 - 2800
3520VQ 3525VQ	NO. 1 - 3600	NO. 11 & NO. 19 - 5100
4520VQ 4525VQ 4535VQ	NO. 1 - 5600	NO. 11 - 7200

*SHAFTS AVAILABLE IN 2520VQ SERIES FOR 3560 LB. IN. CAPABILITY.

Model Code

F3 – 2520 VQ 12 A 11 * 1 CC 6 D 20 L

VITON SEALS
(OMIT IF NOT REQUIRED)

SERIES DESIGNATION
2520 3525 4525
3520 4520 4535

FLEX PLATE VANE TYPE PUMP

GPM CAPACITY - SHAFT END PUMP
(SAE RATING 1200 RPM - 100 PSI)

25**VQ	35**VQ	45**VQ
12	25	42
14	30	50
17	35	60
21	38	

SAE PORT CONNECTIONS
MODELS WITHOUT FLOW CONTROL

CODE	INLET	OUTLET NO. 1 SHAFT END	OUTLET NO. 2 COVER END	PUMP SERIES
A	4-BOLT FLG.	4-BOLT FLG.	4-BOLT FLG.	ALL
C	4-BOLT FLG.	SAE ST. THD.	SAE ST. THD.	2520
E	4-BOLT FLG.	4-BOLT FLG.	SAE ST. THD.	ALL BUT 4535
F	4-BOLT FLG.	SAE ST. THD.	4-BOLT FLG.	2520

MODELS WITH FLOW CONTROL

SERIES 2520VQ				TANK RETURN
CODE	INLET	OUTLET NO. 1	OUTLET NO. 2	
C	4-BOLT FLG.	SAE ST. THD.	SAE ST. THD.	SAE ST. THD.
E	4-BOLT FLG.	4-BOLT FLG.	SAE ST. THD.	SAE ST. THD.
SERIES 3520VQ & 4520VQ				
E	4-BOLT FLG.	4-BOLT FLG.	SAE ST. THD.	SAE ST. THD.

GPM CAPACITY - COVER END PUMP
(SAE RATING 1200 RPM - 100 PSI)

**20VQ	**25VQ	**35VQ
5	12	25
8	14	30
11	17	35
12	21	38
14		

MOUNTING & SHAFT SEAL ASSEMBLY
F - FOOT MOUNT & SINGLE SHAFT SEAL
S - FLANGE MOUNT & DOUBLE SHAFT SEAL
(OMIT FOR FLANGE MOUNT & SINGLE SHAFT SEAL)

SHAFT TYPE

SINGLE SHAFT SEAL PUMPS
1 - STRAIGHT KEYED
11 - SPLINED
19 - SPLINED (3520VQ & 3525VQ ONLY)

DOUBLE SHAFT SEAL PUMPS
110 - SPLINED (SAME AS NO. 19)
123 - SPLINED (SAME AS NO. 11). NOT AVAILABLE ON 45**VQ.
130 - SPLINED (SAME AS NO. 11). 45**VQ ONLY.

SHAFT ROTATION
(VIEWED FROM SHAFT END)
L - LEFT HAND (OMIT FOR RIGHT HAND)

DESIGN NUMBER
SUBJECT TO CHANGE. INSTALLATION DIMENSIONS REMAIN THE SAME FOR DESIGNS 20 THRU 29.

RELIEF VALVE SETTING - PSI
(MODELS WITH FLOW CONTROL)
C - 750
D - 1000
E - 1250
F - 1500
G - 1750
H - 2000
J - 2250
K - 2500

CONTROLLED FLOW RATE - GPM
(MODELS WITH FLOW CONTROL)
2, 4, 6, 7, 8, 10 OR 12 GPM

OUTLET POSITIONS
(VIEWED FROM COVER END OF PUMP)

ALL SERIES EXCEPT 4535VQ

WITH NO. 1 OUTLET OPPOSITE INLET
AA - NO. 2 OUTLET 135° CCW FROM INLET
AB - NO. 2 OUTLET 45° CCW FROM INLET
AC - NO. 2 OUTLET 45° CW FROM INLET
AD - NO. 2 OUTLET 135° CW FROM INLET

WITH NO. 1 OUTLET 90° CCW FROM INLET
BA - NO. 2 OUTLET 135° CCW FROM INLET
BB - NO. 2 OUTLET 45° CCW FROM INLET
BC - NO. 2 OUTLET 45° CW FROM INLET
BD - NO. 2 OUTLET 135° CW FROM INLET

WITH NO. 1 OUTLET INLINE WITH INLET
CA - NO. 2 OUTLET 135° CCW FROM INLET
CB - NO. 2 OUTLET 45° CCW FROM INLET
CC - NO. 2 OUTLET 45° CW FROM INLET
CD - NO. 2 OUTLET 135° CW FROM INLET

WITH NO. 1 OUTLET 90° CW FROM INLET
DA - NO. 2 OUTLET 135° CCW FROM INLET
DB - NO. 2 OUTLET 45° CCW FROM INLET
DC - NO. 2 OUTLET 45° CW FROM INLET
DD - NO. 2 OUTLET 135° CW FROM INLET

SERIES 4535VQ

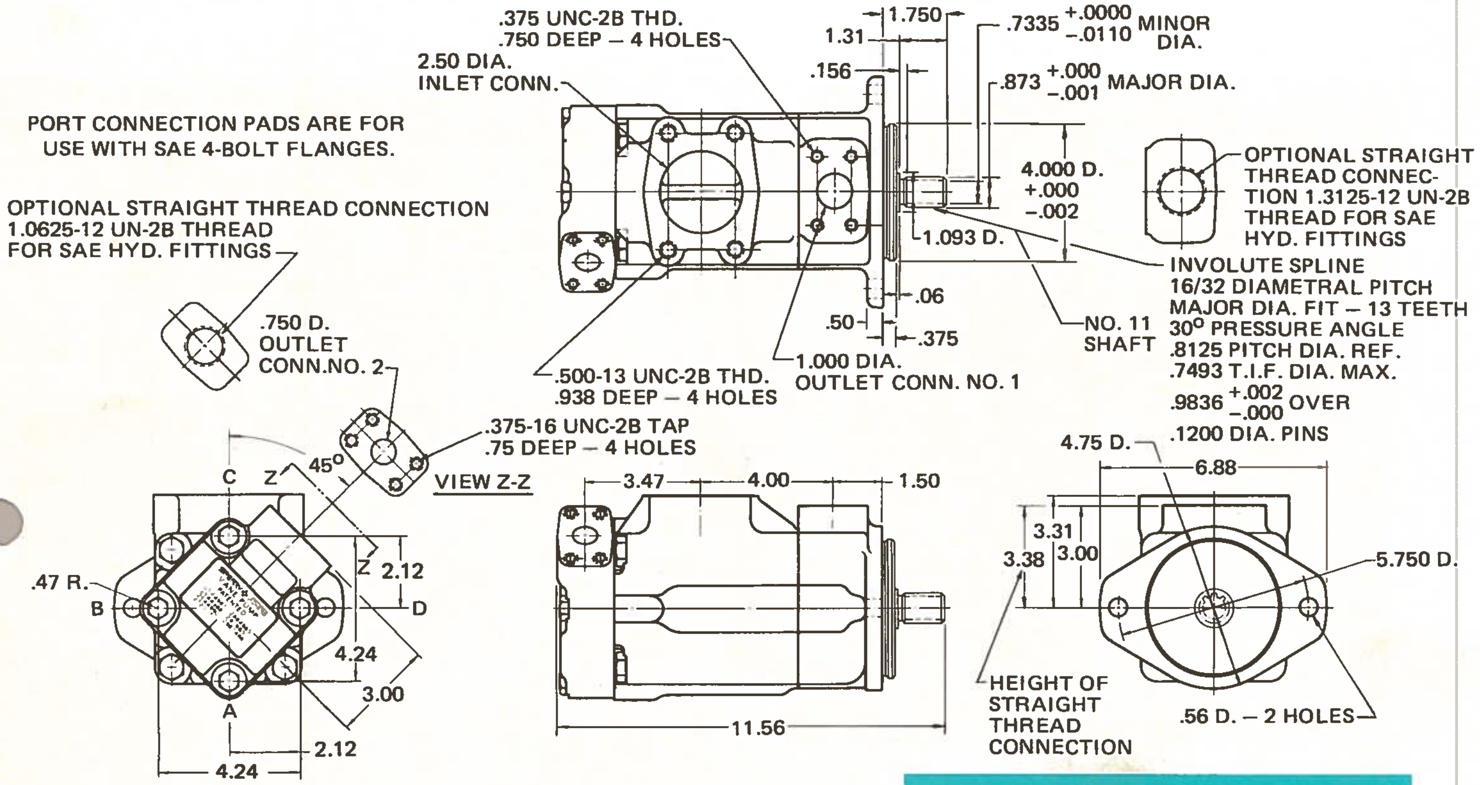
WITH NO. 1 OUTLET OPPOSITE INLET
AA - NO. 2 OUTLET OPPOSITE INLET
AB - NO. 2 OUTLET 90° CCW FROM INLET
AC - NO. 2 OUTLET INLINE WITH INLET
AD - NO. 2 OUTLET 90° CW FROM INLET

WITH NO. 1 OUTLET 90° CCW FROM INLET
BA - NO. 2 OUTLET OPPOSITE INLET
BB - NO. 2 OUTLET 90° CCW FROM INLET
BC - NO. 2 OUTLET INLINE WITH INLET
BD - NO. 2 OUTLET 90° CW FROM INLET

WITH NO. 1 OUTLET INLINE WITH INLET
CA - NO. 2 OUTLET OPPOSITE INLET
CB - NO. 2 OUTLET 90° CCW FROM INLET
CC - NO. 2 OUTLET INLINE WITH INLET
CD - NO. 2 OUTLET 90° CW FROM INLET

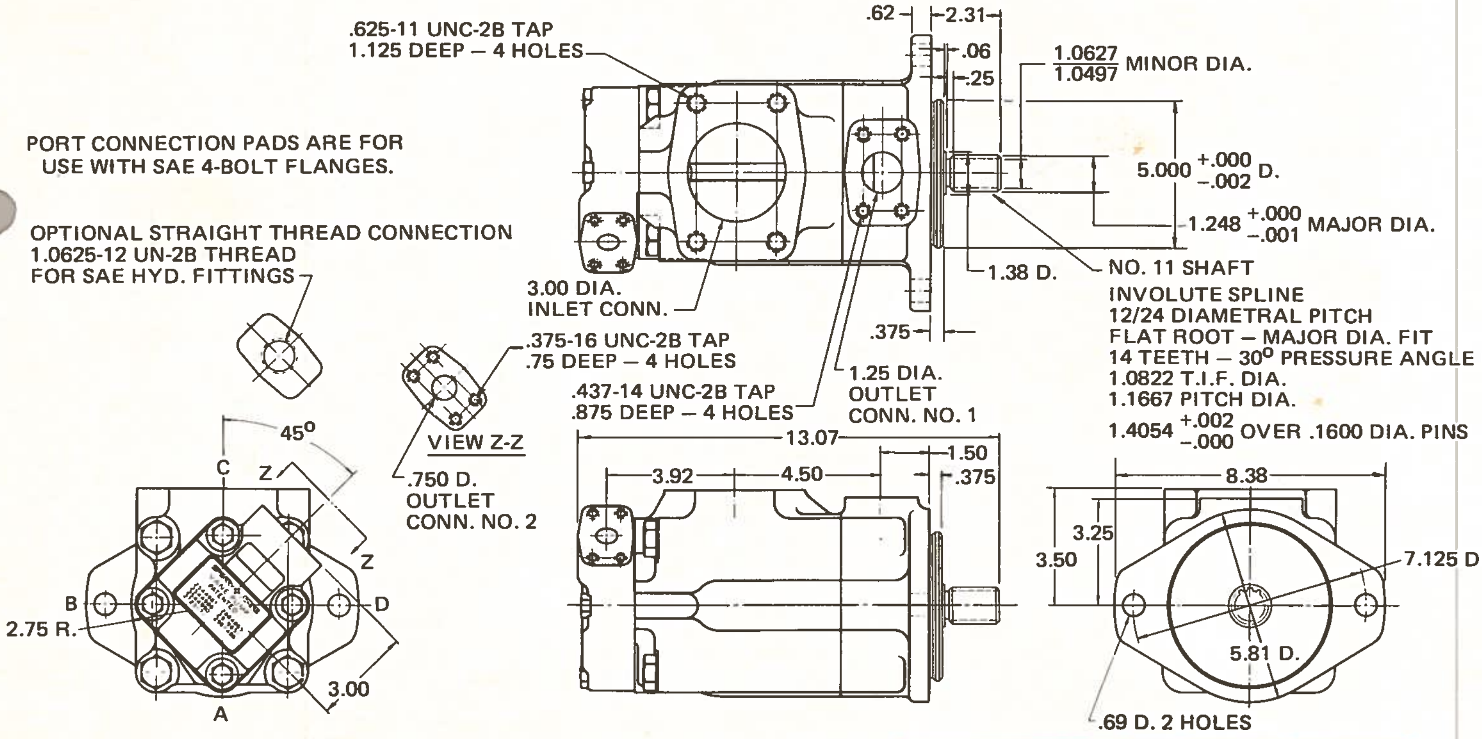
WITH NO. 1 OUTLET 90° CW FROM INLET
DA - NO. 2 OUTLET OPPOSITE INLET
DB - NO. 2 OUTLET 90° CCW FROM INLET
DC - NO. 2 OUTLET INLINE WITH INLET
DD - NO. 2 OUTLET 90° CW FROM INLET

Installation Dimensions



2520VQ series

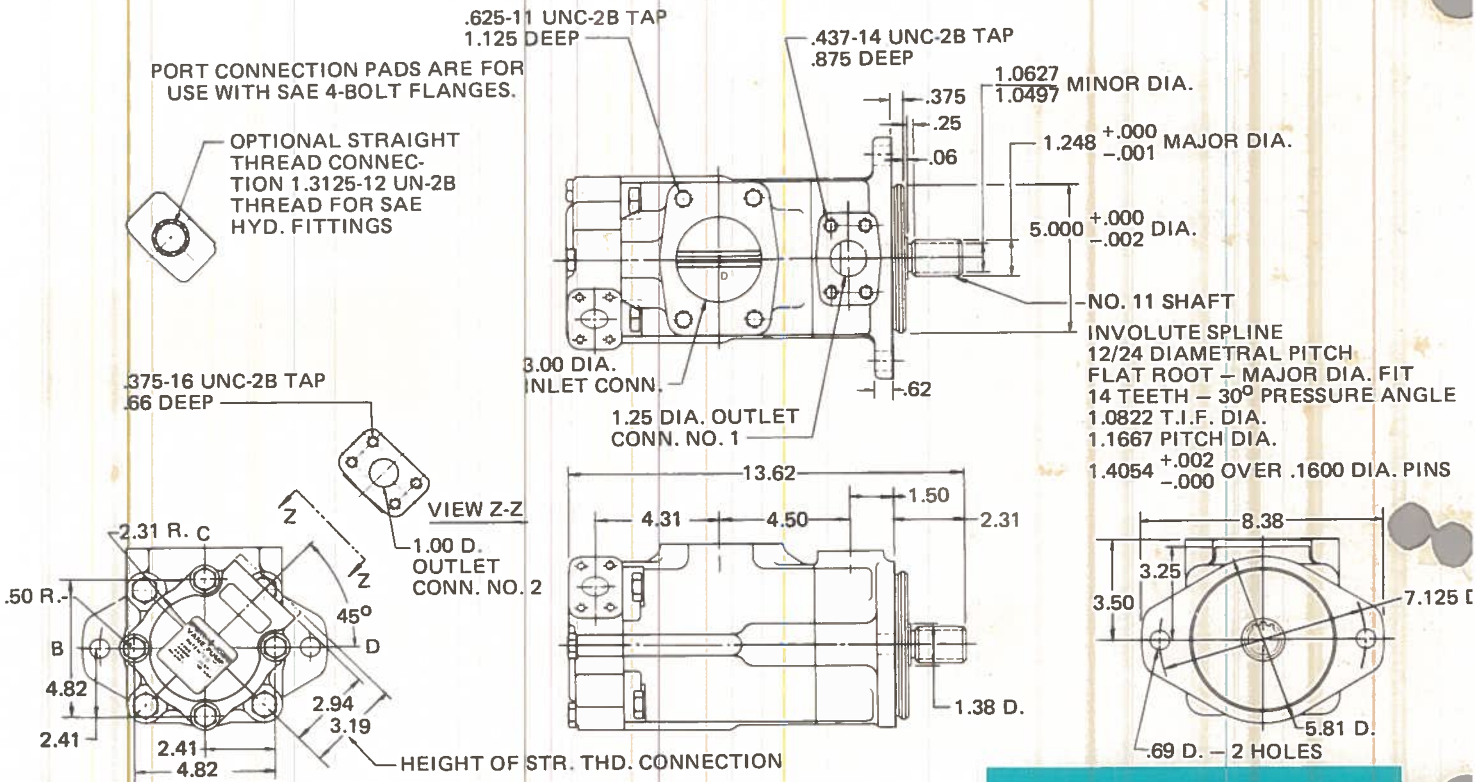
Shaft options shown on page 17.



3520VQ series

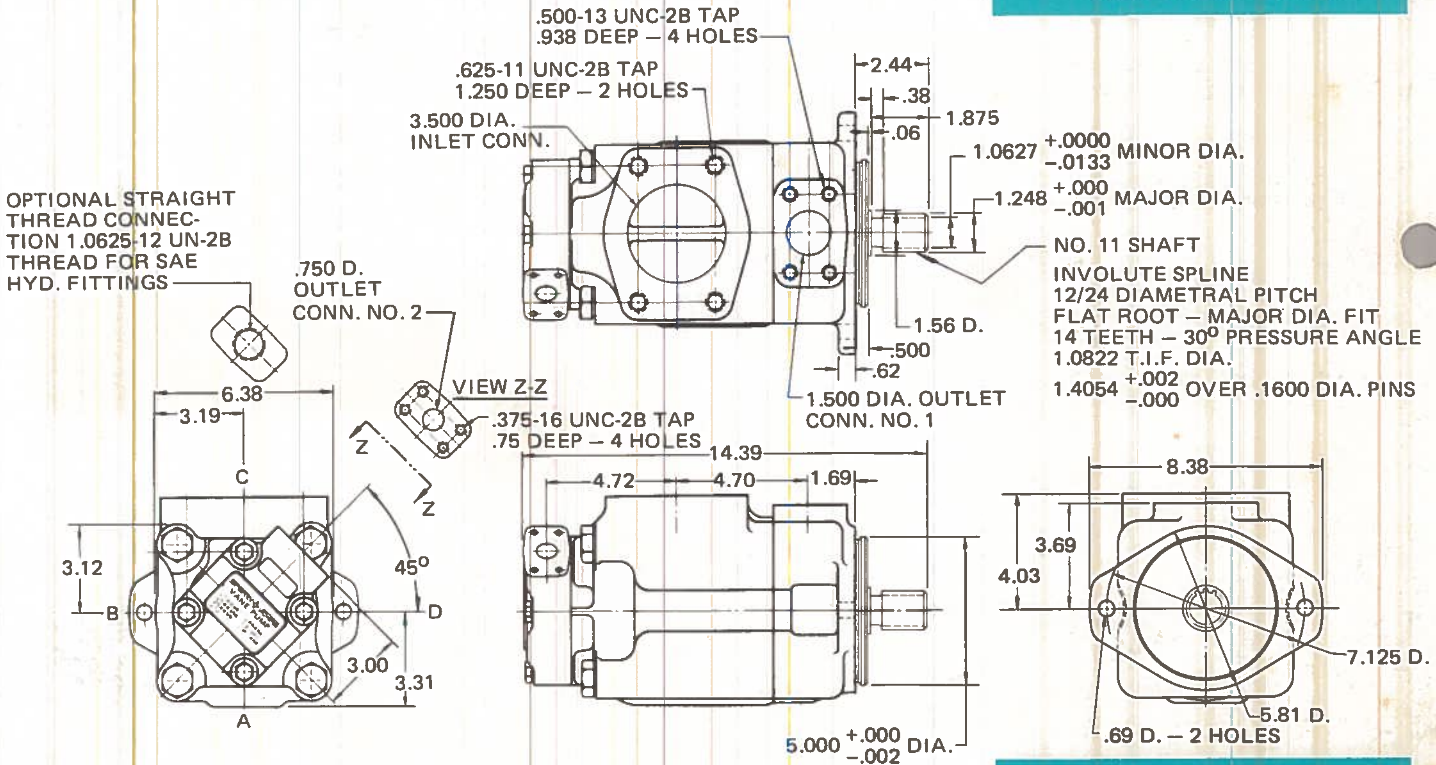
Shaft options shown on page 17.

Installation Dimensions (cont.)



3525VQ series

Shaft options shown on page 17.



4520VQ series

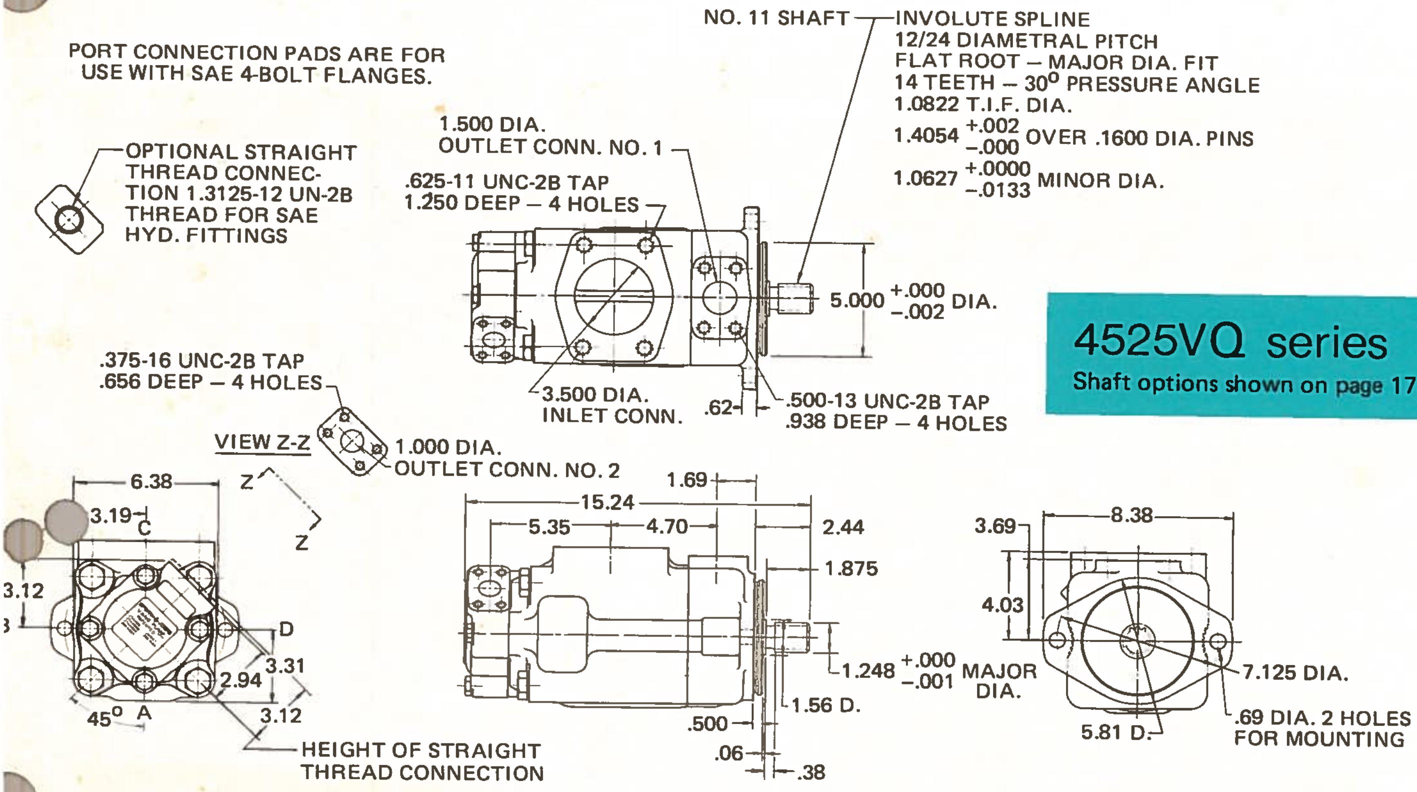
Shaft options shown on page 17.

4525VQ series

Shaft options shown on page 17.

PORT CONNECTION PADS ARE FOR USE WITH SAE 4-BOLT FLANGES.

NO. 11 SHAFT — INVOLUTE SPLINE
12/24 DIAMETRAL PITCH
FLAT ROOT – MAJOR DIA. FIT
14 TEETH – 30° PRESSURE ANGLE
1.0822 T.I.F. DIA.
$1.4054^{+.002}_{-.000}$ OVER .1600 DIA. PINS
$1.0627^{+.0000}_{-.0133}$ MINOR DIA.

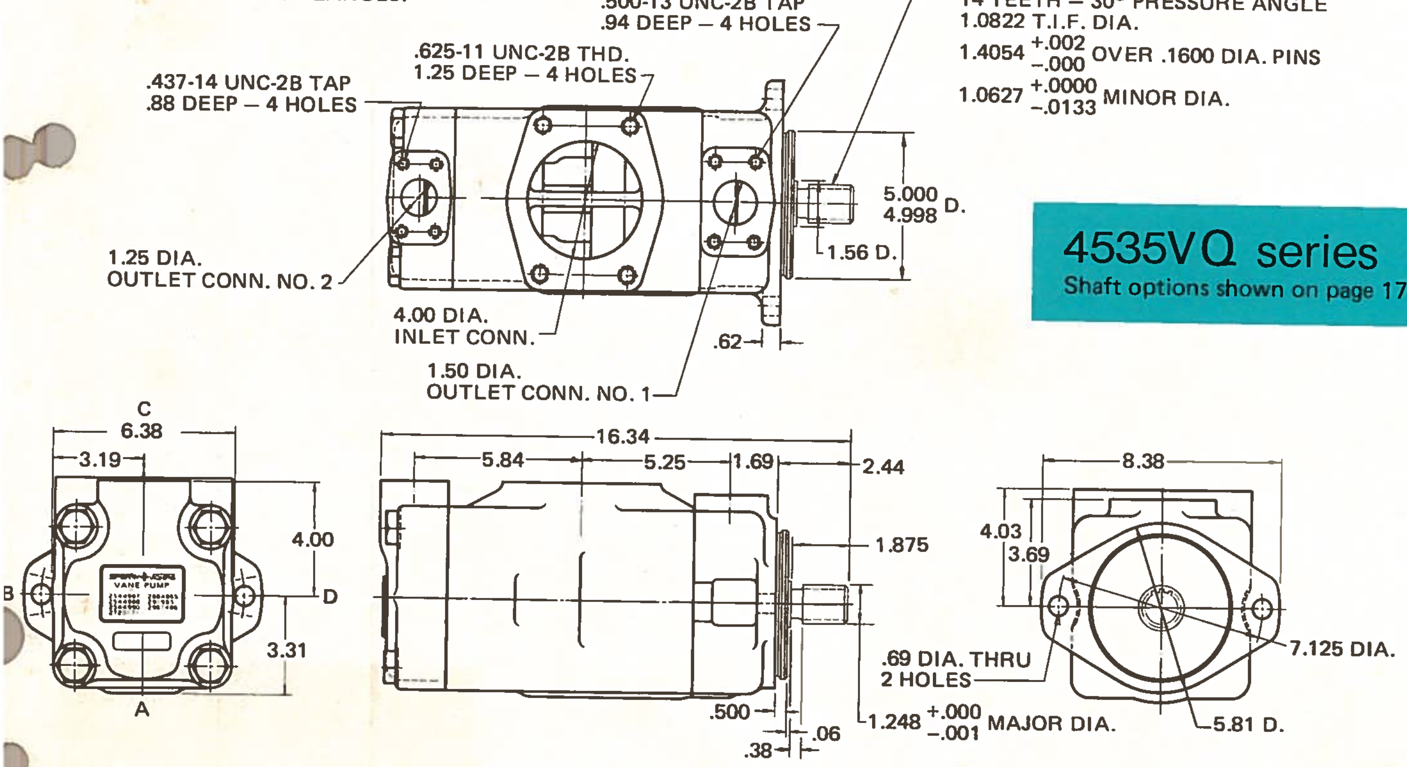

OPTIONAL STRAIGHT THREAD CONNECTION 1.3125-12 UN-2B THREAD FOR SAE HYD. FITTINGS
1.500 DIA. OUTLET CONN. NO. 1
.625-11 UNC-2B TAP 1.250 DEEP – 4 HOLES
5.000 +.000 −.002 DIA.
.375-16 UNC-2B TAP .656 DEEP – 4 HOLES
3.500 DIA. INLET CONN.
.62
.500-13 UNC-2B TAP .938 DEEP – 4 HOLES
VIEW Z-Z
1.000 DIA. OUTLET CONN. NO. 2
6.38
Z
3.19
C
Z
3.12
B
D
3.31
2.94
45°
A
3.12
HEIGHT OF STRAIGHT THREAD CONNECTION
1.69
15.24
5.35
4.70
2.44
1.875
1.248 +.000 −.001 MAJOR DIA.
1.56 D.
.500
.06
.38
3.69
8.38
4.03
7.125 DIA.
5.81 D.
.69 DIA. 2 HOLES FOR MOUNTING

4535VQ series

Shaft options shown on page 17.

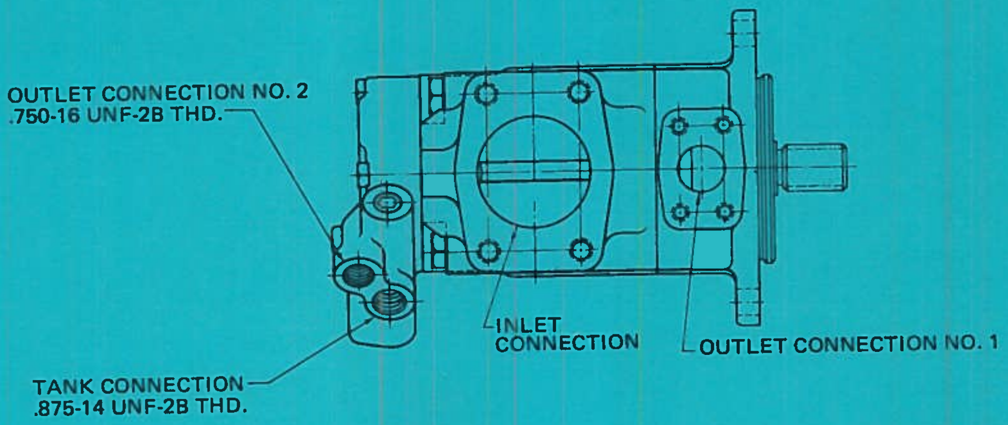
PORT CONNECTION PADS ARE FOR USE WITH SAE 4-BOLT FLANGES.

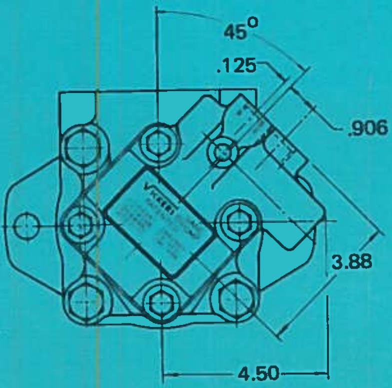
NO. 11 SHAFT — INVOLUTE SPLINE
12/24 DIAMETRAL PITCH
FLAT ROOT – MAJOR DIA. FIT
14 TEETH – 30° PRESSURE ANGLE
1.0822 T.I.F. DIA.
$1.4054^{+.002}_{-.000}$ OVER .1600 DIA. PINS
$1.0627^{+.0000}_{-.0133}$ MINOR DIA.

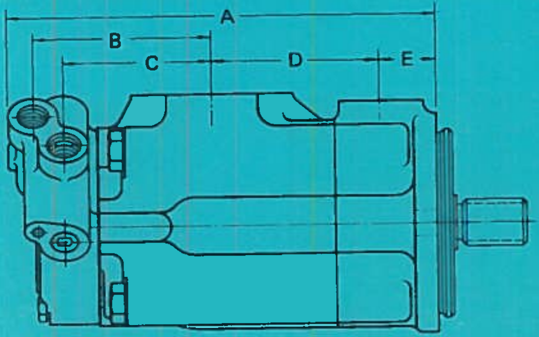

.500-13 UNC-2B TAP .94 DEEP – 4 HOLES
.625-11 UNC-2B THD. 1.25 DEEP – 4 HOLES
.437-14 UNC-2B TAP .88 DEEP – 4 HOLES
5.000 4.998 D.
1.56 D.
1.25 DIA. OUTLET CONN. NO. 2
4.00 DIA. INLET CONN.
.62
1.50 DIA. OUTLET CONN. NO. 1
C
6.38
3.19
4.00
B
D
3.31
A
16.34
5.84
5.25
1.69
2.44
1.875
.500
.38
.06
1.248 +.000 −.001 MAJOR DIA.
8.38
4.03
3.69
.69 DIA. THRU 2 HOLES
7.125 DIA.
5.81 D.

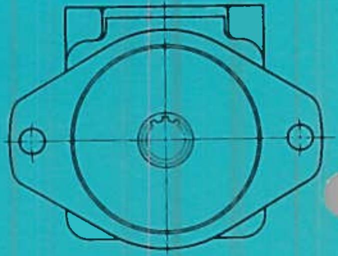
Installation Dimensions (cont.)

Pumps with integral valving









FLOW CONTROL COVER					
MODEL SERIES	DIMENSIONS				
	A	B	C	D	E
2520VQ	10.47	4.28	3.47	4.00	1.50
3520VQ	11.41	4.73	3.92	4.50	1.50
4520VQ	12.61	5.53	4.72	4.70	1.69

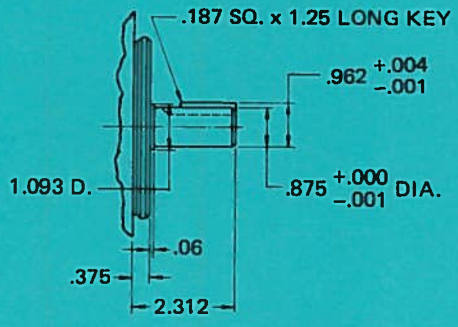
NOTE: FOR INSTALLATION DIMENSIONS AND PERFORMANCE DATA OF BASIC PUMP SERIES REFER TO PRECEDING PAGES.

The combination flow control/relief valve is located in the pump's cover and is operative in the cover end pump circuit. Pump delivery is approximately proportional to speed, but the volume delivered from the cover end pump is limited by the flow control valve. Excess flow is diverted to the tank port. Pressure protection of the cover end pump circuit is provided by the integral relief valve. Operating pressure of the shaft end pump must be controlled by a separate, external relief valve.

Optional Shafts

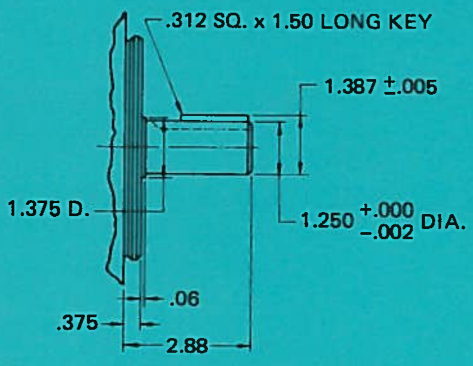
SERIES 2520VQ

NO. 1 STRAIGHT KEY SHAFT



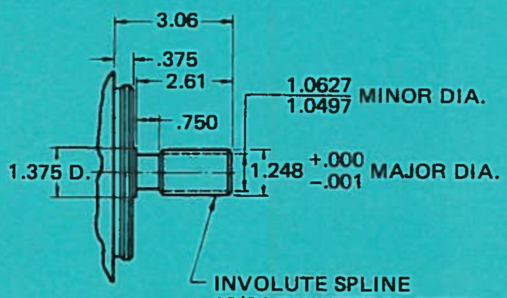
SERIES 3520VQ & 3525VQ

NO. 1 STRAIGHT KEY SHAFT



SERIES 3520VQ & 3525VQ

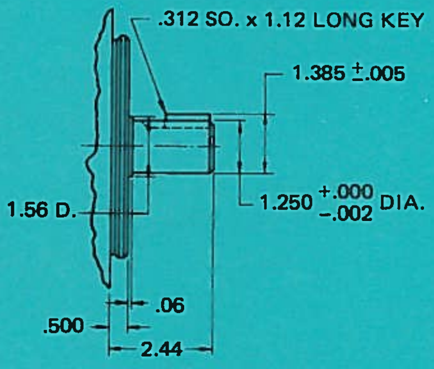
NO. 19 SPLINED SHAFT



INVOLUTE SPLINE
12/24 DIAMETRAL PITCH
FLAT ROOT – MAJOR DIA. FIT
14 TEETH – 30° PRESSURE ANGLE
1.0822 T.I.F. DIA
1.1667 PITCH DIA.
1.4054 +.002 −.000 OVER .1600 DIA. PINS

SERIES 4520VQ, 4525VQ & 4535VQ

NO. 1 STRAIGHT KEY SHAFT



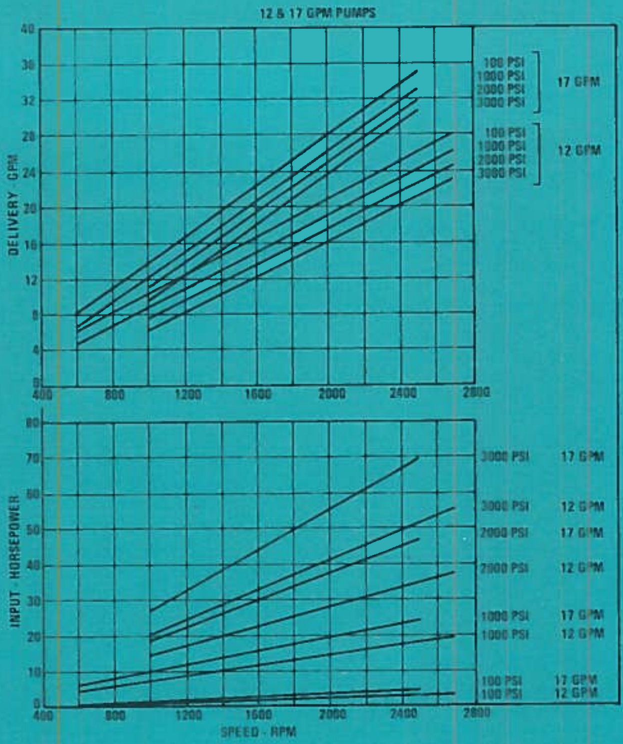
Typical Performance

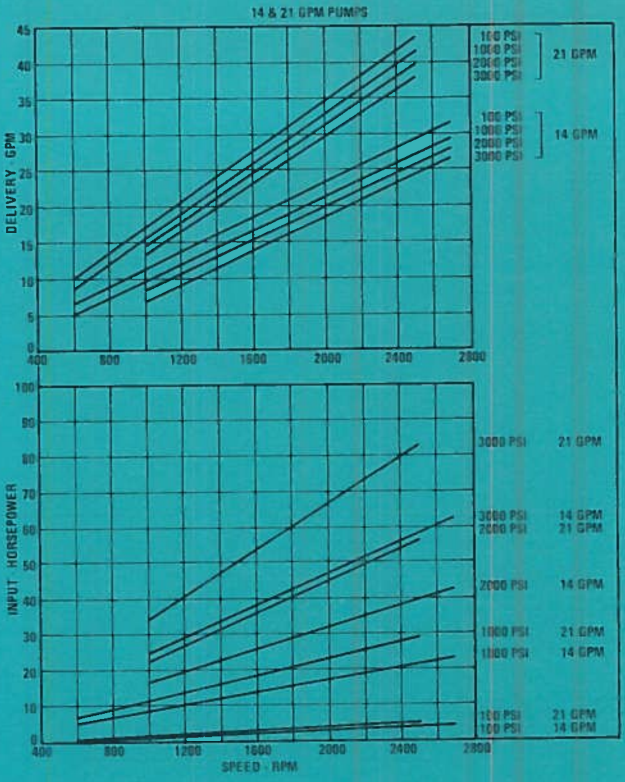
Shaft-end Pumps

Performance Constants:

SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

2520VQ
Double Pumps

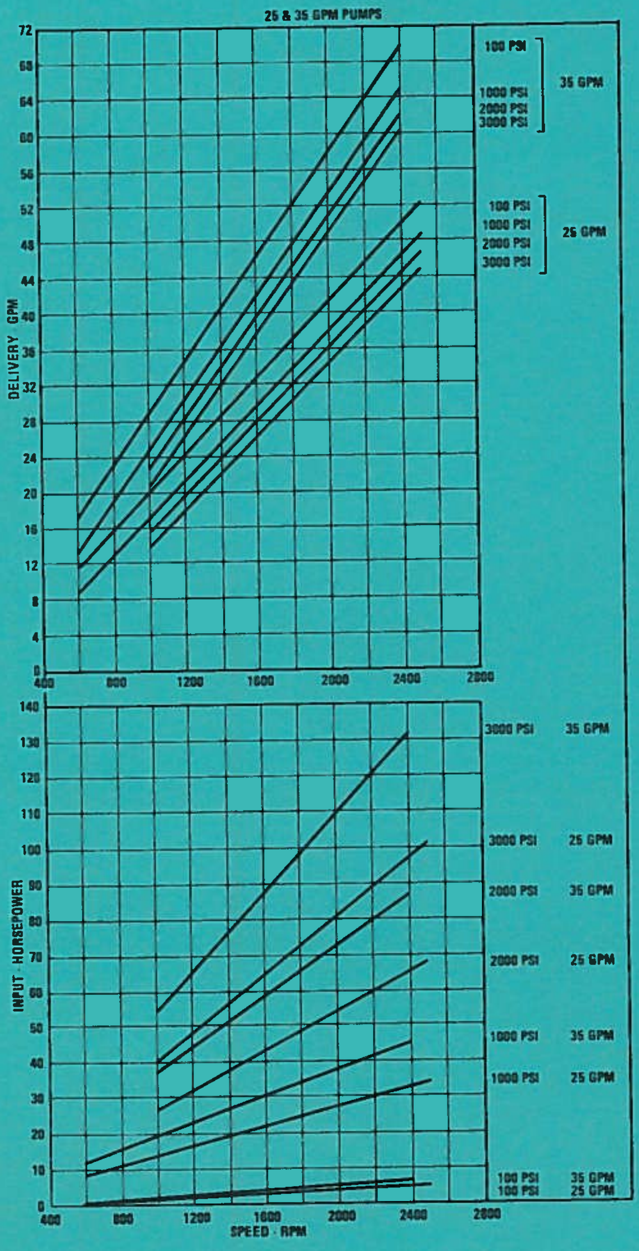


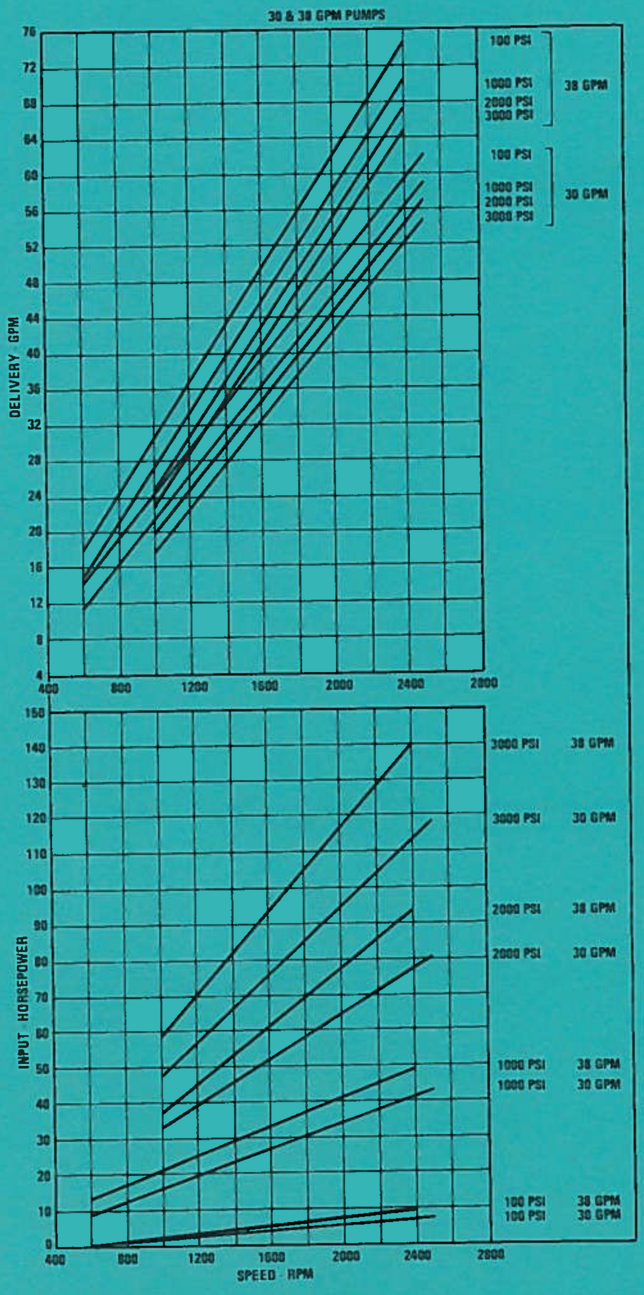


Shaft-end Pumps

Performance Constants:
SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

3520VQ & 3525VQ
Double Pumps



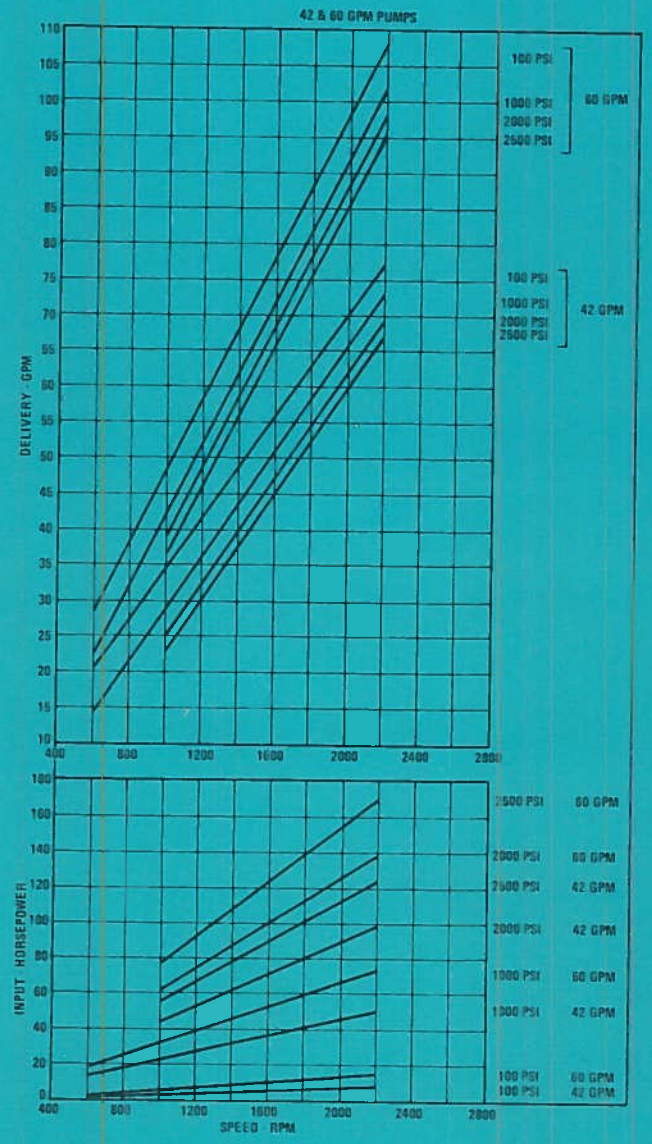


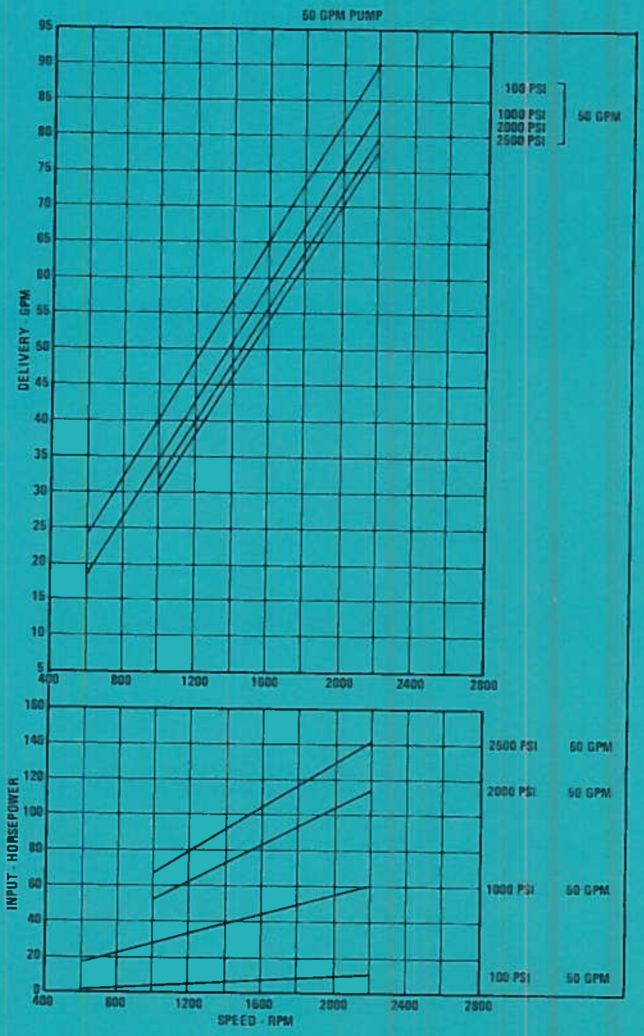
Typical Performance (cont.)

Shaft-end Pumps

Performance Constants:
SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

4520VQ, 4525VQ & 4535VQ
Double Pumps

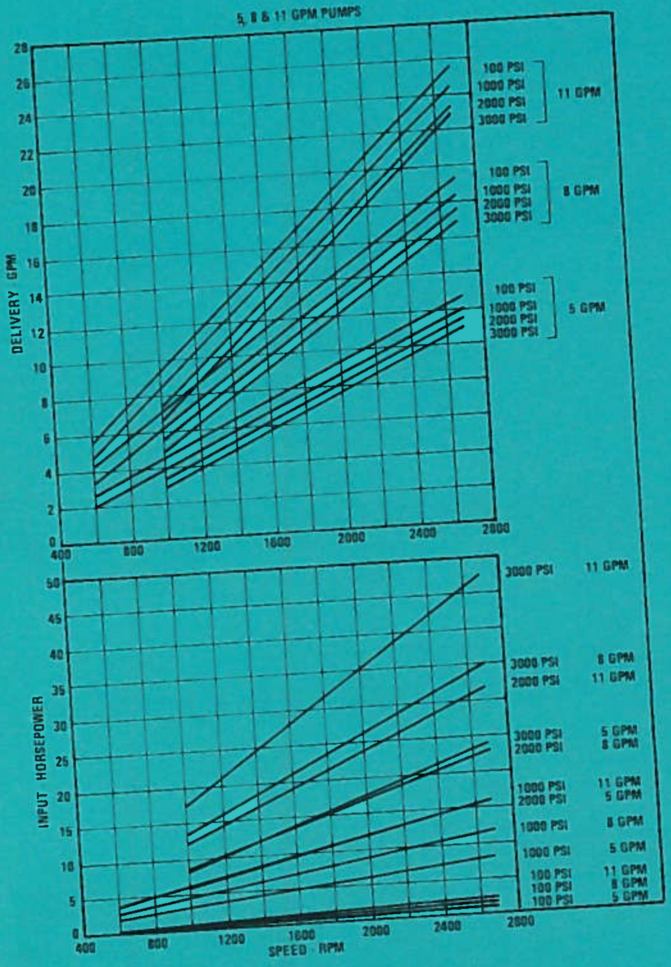


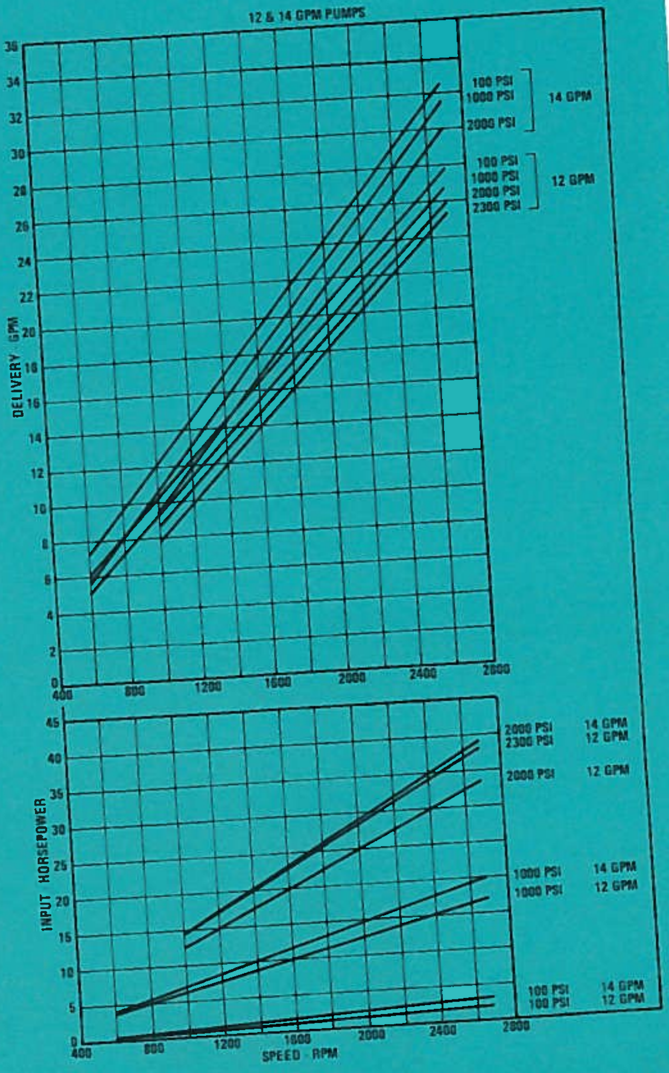


Cover-end Pumps

Performance Constants:
SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

2520VQ
Double Pumps



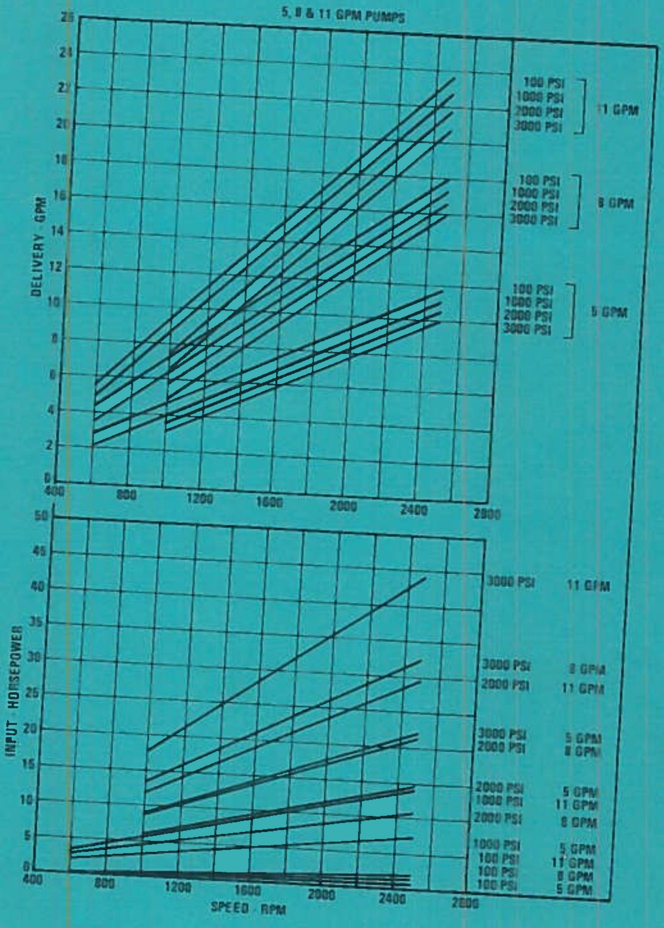


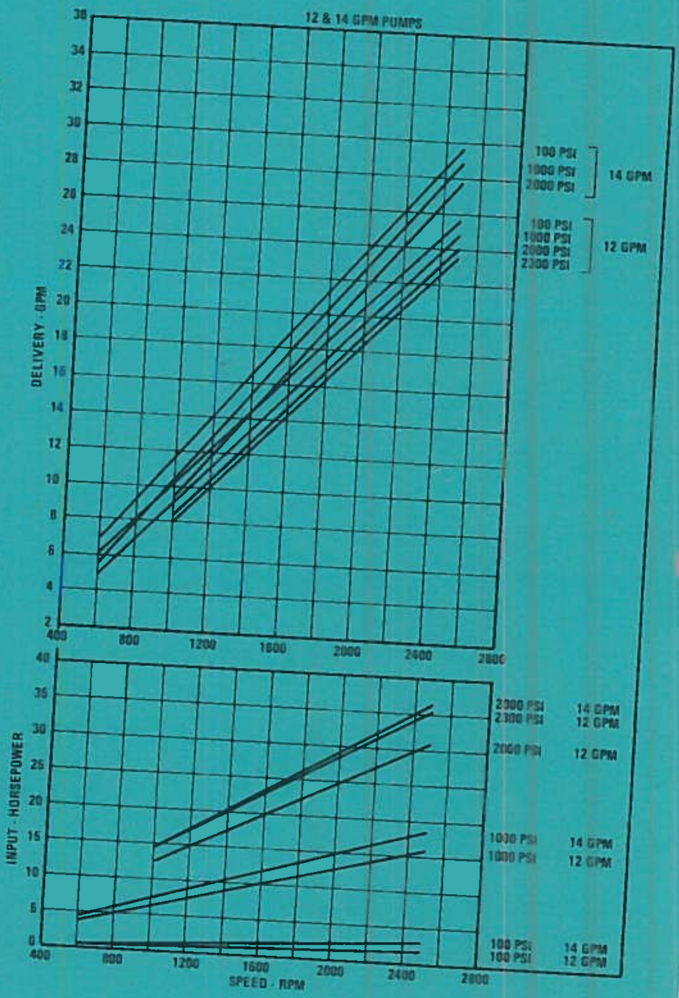
Typical Performance (cont.)

Cover-end Pumps

Performance Constants:
SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

3520VQ
Double Pumps

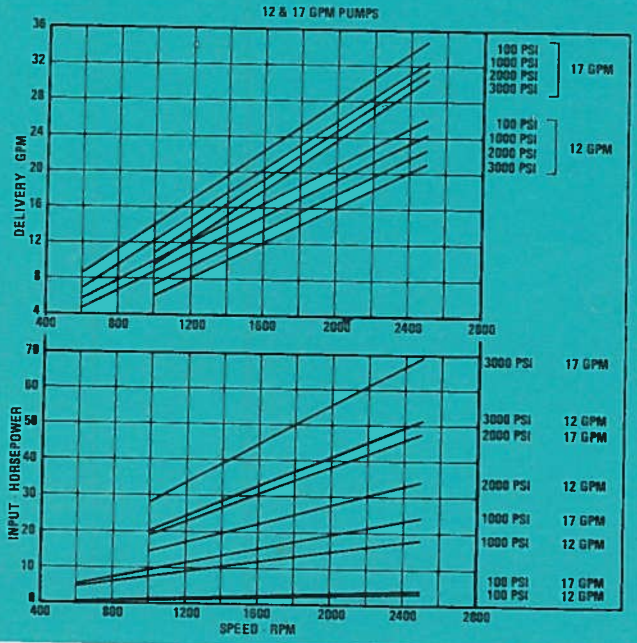


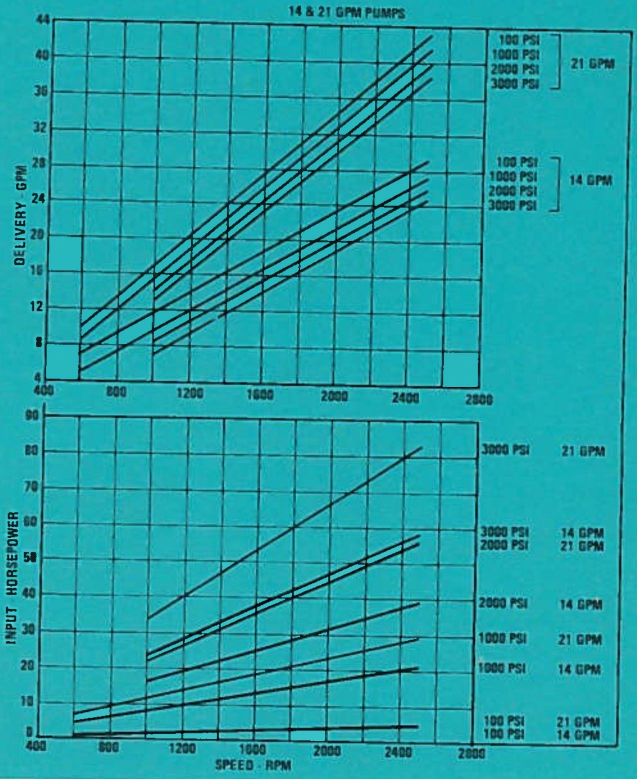


Cover-end Pumps

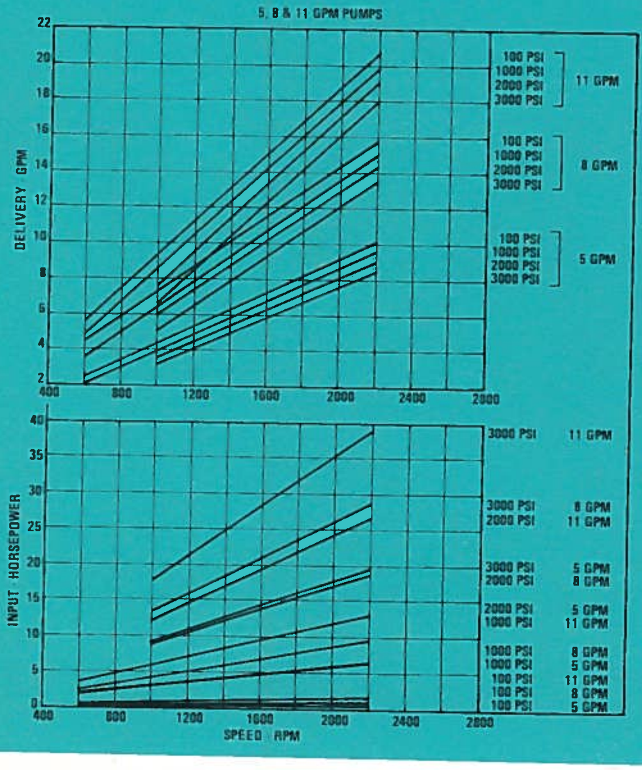
Performance Constants: SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

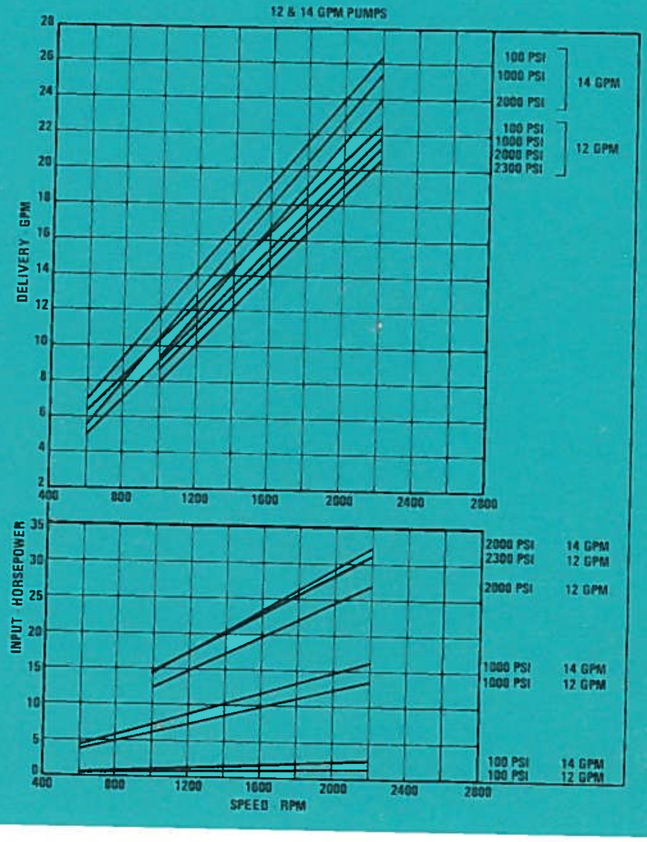
3525VQ Double Pumps





4520VQ Double Pumps



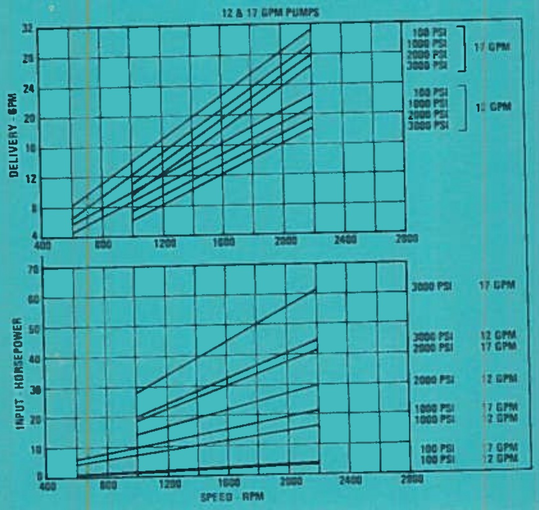


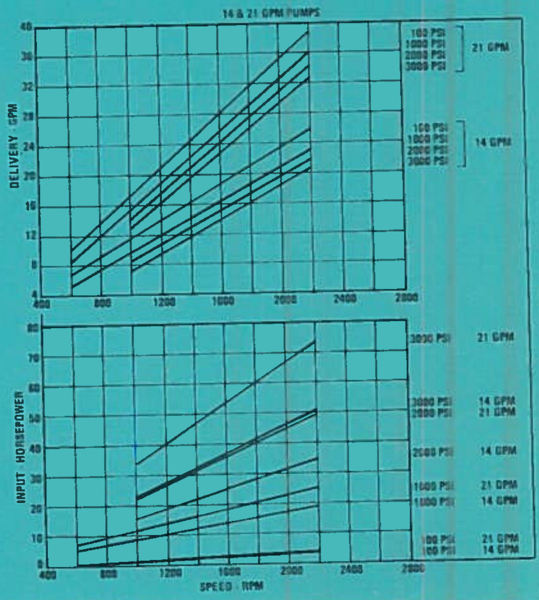
Typical Performance (cont.)

Cover-end Pumps

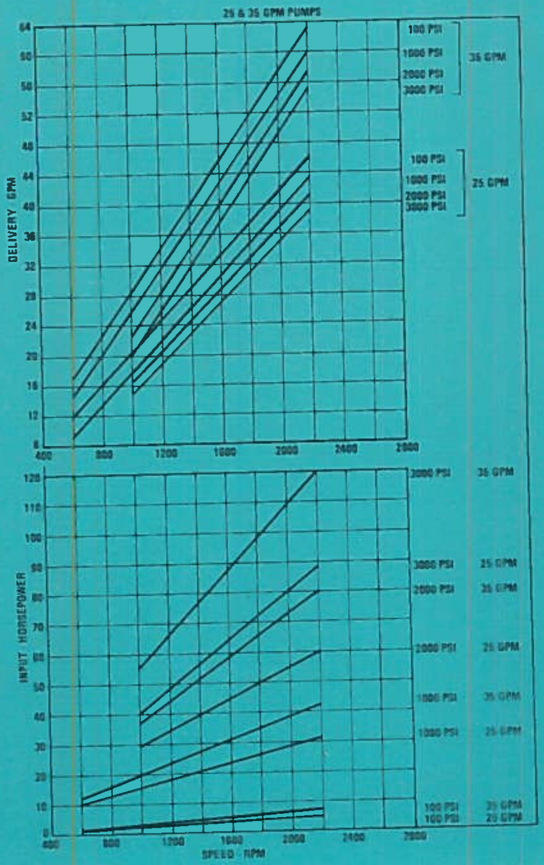
Performance Constants: SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

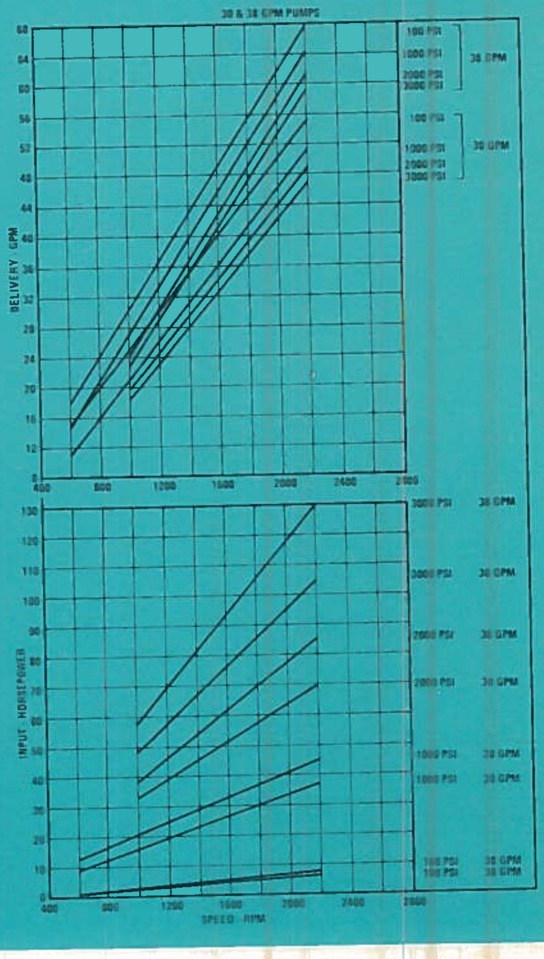
4525VQ Double Pumps





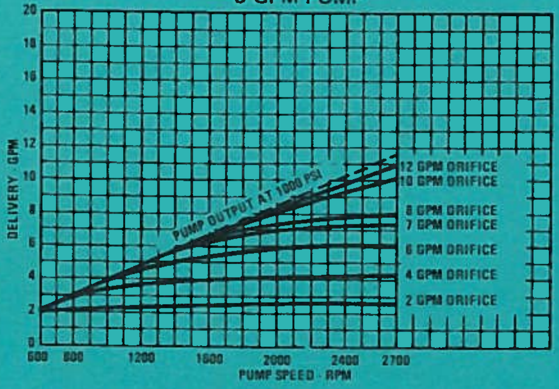
4535VQ Double Pumps



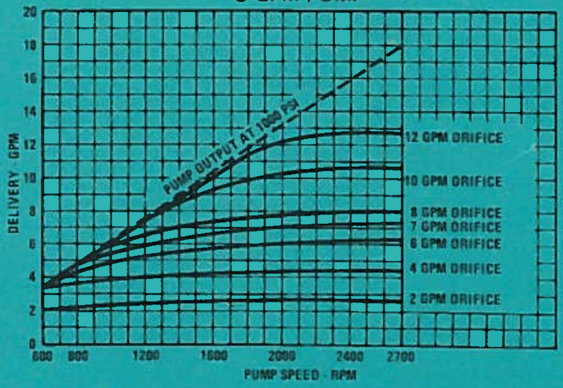


Controlled flow—integral valving models 2520VQ, 3520VQ & 4520VQ Double Pumps

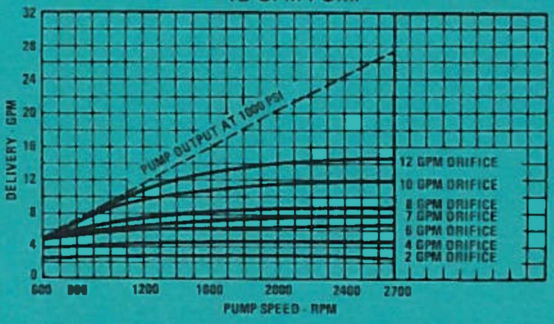
5 GPM PUMP



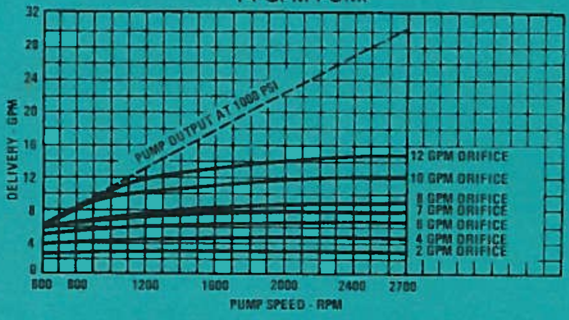
8 GPM PUMP



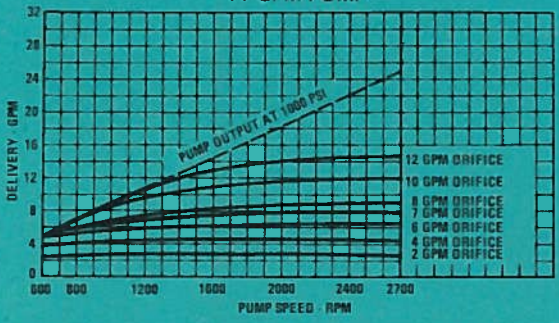
12 GPM PUMP



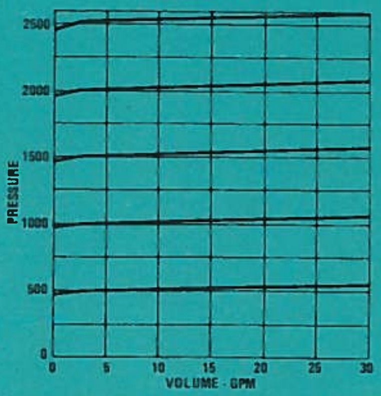
14 GPM PUMP



11 GPM PUMP



RELIEF VALVE PRESSURE
OVERRIDE CHARACTERISTICS
(ALL SERIES)



Performance Constants:

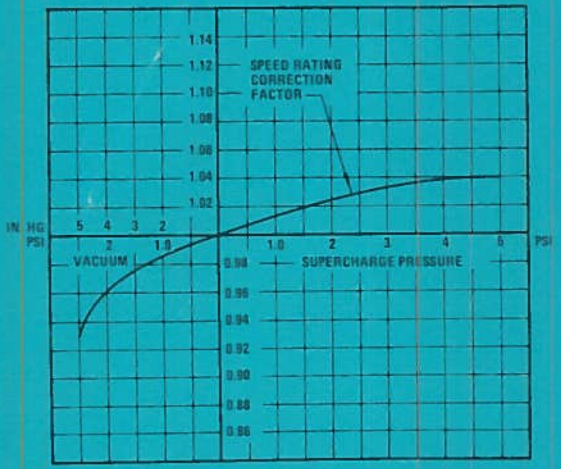
SAE 10W fluid @ 180°F.
Pump inlet @ O PSIG (14.7 PSIA)

Curves shown for 1000 psi operating pressure. Controlled flow varies slightly at other pressures.

Speed Correction Curves

MAXIMUM OPERATING SPEED CORRECTION FACTORS
BASED ON PUMP INLET CONDITIONS

SERIES 2520VQ

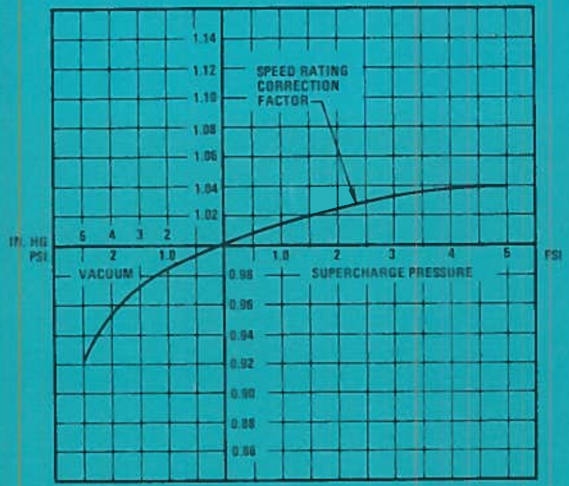


MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR SHOWN IN THE CURVE ABOVE.

EXAMPLE: MAX. SPEED @ 0 PSI INLET 2700 RPM
CORRECTION FACTOR @ 5 IN. HG x .93
MAX. SPEED @ 5 IN. HG. INLET 2511 RPM

PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

SERIES 3520VQ & 3525VQ

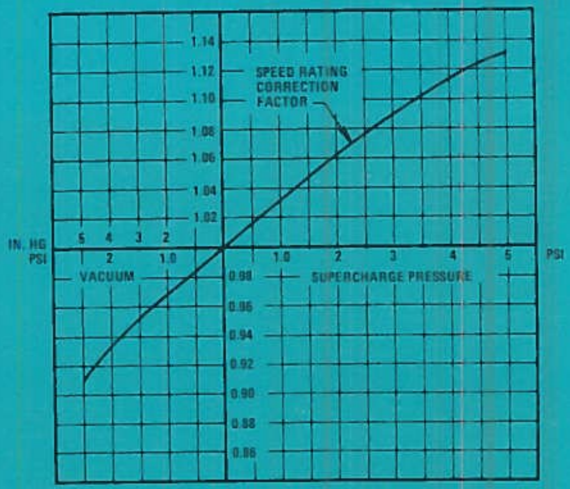


MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR SHOWN IN THE CURVE ABOVE.

EXAMPLE: MAX. SPEED @ 0 PSI INLET 2500 RPM
CORRECTION FACTOR @ 5 IN. HG. x .92
MAX. SPEED @ 5 IN. HG. INLET 2300 RPM

PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

SERIES 4520VQ, 4525VQ, 4535VQ



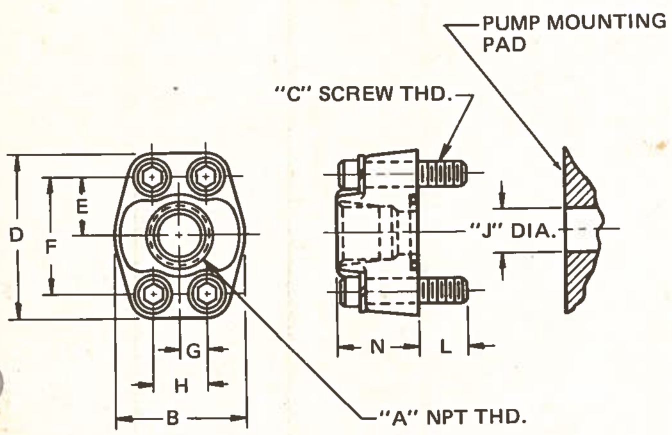
MAXIMUM OPERATING SPEEDS SHOWN ON PERFORMANCE CURVES ARE FOR PUMPS OPERATING AT 0 PSI INLET CONDITION. TO COMPUTE MAXIMUM OPERATING SPEEDS AT OTHER INLET CONDITIONS USE THE APPROPRIATE SPEED RATING CORRECTION FACTOR SHOWN IN THE CURVE ABOVE.

EXAMPLE: MAX. SPEED @ 0 PSI INLET 2200 RPM
CORRECTION FACTOR @ 5 IN. HG. x .91
MAX. SPEED @ 5 IN. HG. INLET 2002 RPM

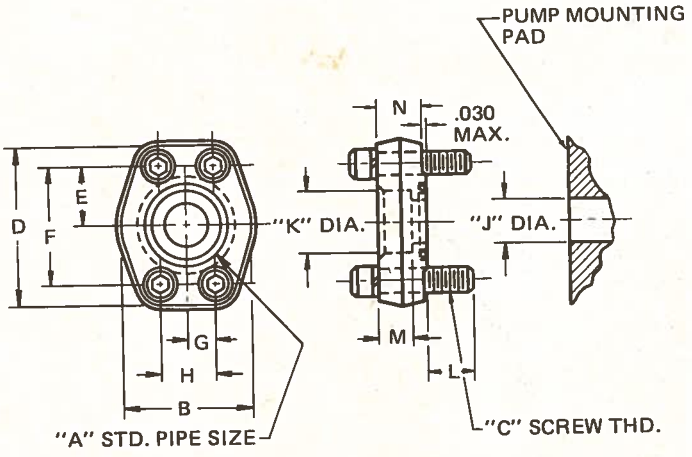
PUMP INLET SUCTION SHOULD NOT EXCEED 5 IN. HG. VACUUM. POSITIVE PRESSURE ON INLET SHOULD NOT EXCEED 20 PSI.

SAE 4-bolt Solid Flanges

PIPE THREADED CONNECTIONS



PIPE WELDED CONNECTIONS



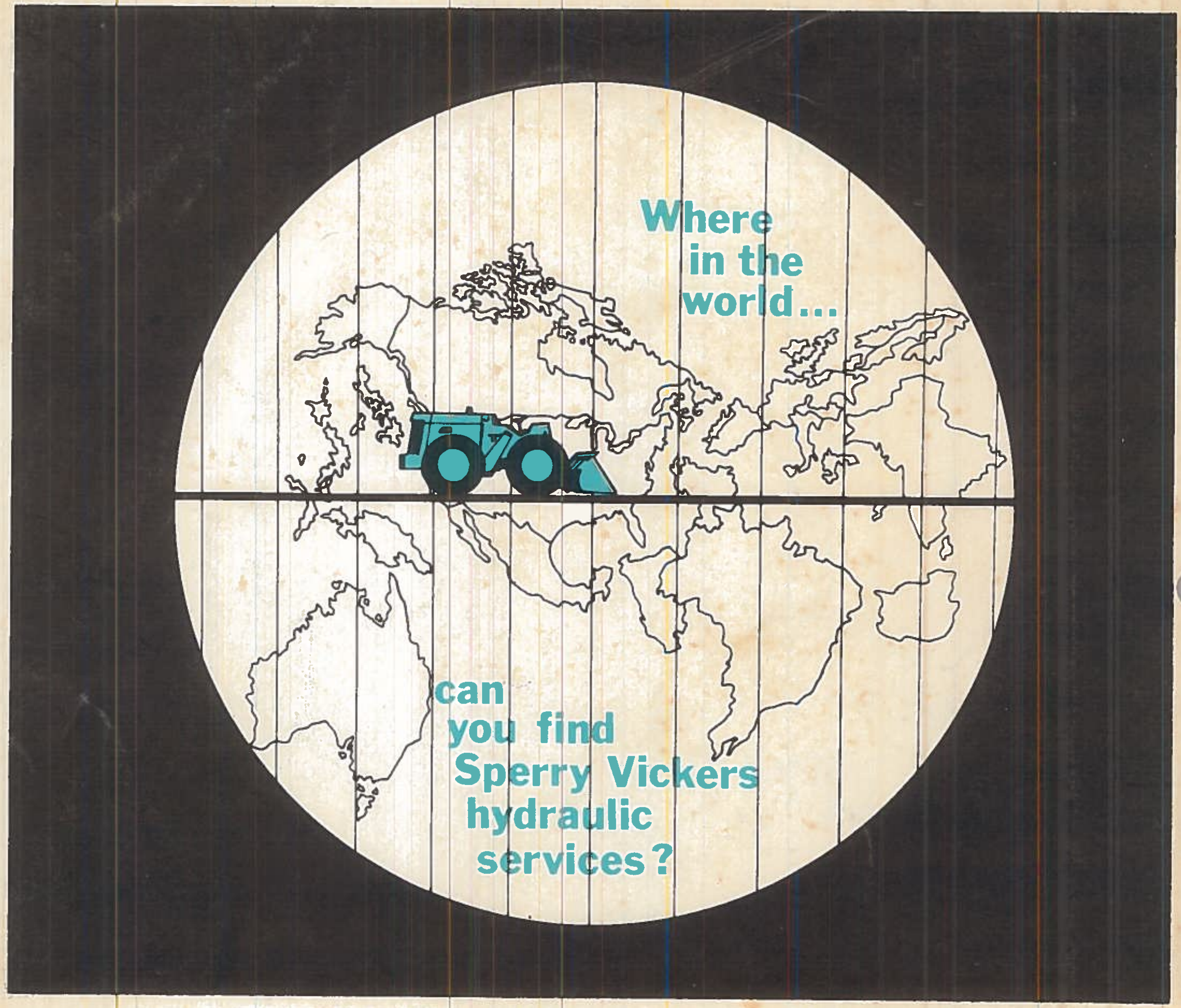
FLANGES ARE FURNISHED WITH THE NECESSARY SEALS, SCREWS AND LOCKWASHERS FOR MOUNTING.

EXAMPLE OF MODEL NUMBER

MODEL FL1-8-08P	DESIGN 10

DESIGN NUMBERS SUBJECT TO CHANGE. INSTALLATION DIMENSIONS REMAIN AS SHOWN FOR DESIGN NUMBERS 10 THRU 19.

MODEL NUMBER		ASSEMBLY NUMBER		PIPE SIZE IN.	DIMENSIONS												MAXIMUM PSI PRESSURE
PIPE THREADED	PIPE WELDED			A	B	C	D	E	F	G	H	J	K	L	M	N	
FL1-6-06P-10		246924		3/4	2.06	3/8 -16	2.56	.93	1.875	.43	.875	.750		.53		1.25	3000
FL1-8-08P-10		229125		1	2.31	3/8 -16	2.75	1.03	2.062	.52	1.032	1.00	1.333	.66	.625	1.38	
	FL1-8-08W-10		246066											.75		.875	
FL1-10-10P-10		229126		1-1/4	2.88	7/16-14	3.12	1.16	2.312	.59	1.188	1.25	1.677	.84	.688	1.50	
	FL1-10-10W-10		246067											.94		.938	
FL1-12-12P-10		229127		1-1/2	3.25	1/2 -13	3.69	1.38	2.75	.70	1.406	1.50	1.927	.73	.75	1.62	
	FL1-12-12W-10		246068											.89		1.188	
FL1-16-16P-10		229128		2	3.81	1/2 -13	4.00	1.53	3.062	.84	1.688	2.00	2.411	.73	.875	1.62	
	FL1-16-16W-10		246069											.95		1.375	
FL1-20-20P-10		229129		2-1/2	4.28	1/2 -13	4.50	1.75	3.50	1.00	2.00	2.50	2.911	.86	1.00	2.00	
	FL1-20-20W-10		246070											1.07		1.750	
FL1-24-24P-10		246925		3	5.16	5/8 -11	5.31	2.09	4.188	1.22	2.438	3.00	3.547	.98	1.25	2.25	
	FL1-24-24W-10		246071											.95		2.125	
FL1-24-24P-LP-10		289361												.73		2.25	500
	FL1-24-24W-LP-10		289360											.70		2.125	
	FL1-28-28W-10		261880	3-1/2	5.5	5/8 -11	6.0	2.38	4.75	1.38	2.75	3.50	4.05	1.13	1.19	1.44	
	FL1-32-32W-10		261881	4	6.0	5/8 -11	6.38	2.56	5.12	1.53	3.06	4.0	4.58	1.07	1.25	1.50	



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- Australia
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- Belgium
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- Canada
- Chile
- Colombia
- Denmark
- England
- Finland
- France
- Germany
- Greece
- Holland
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- India
- Ireland
- Israel
- Italy
- Japan
- Malaysia
- Mexico
- New Zealand
- Norway
- Panama
- Peru
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- South Africa
- South Korea
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Form MB-199A

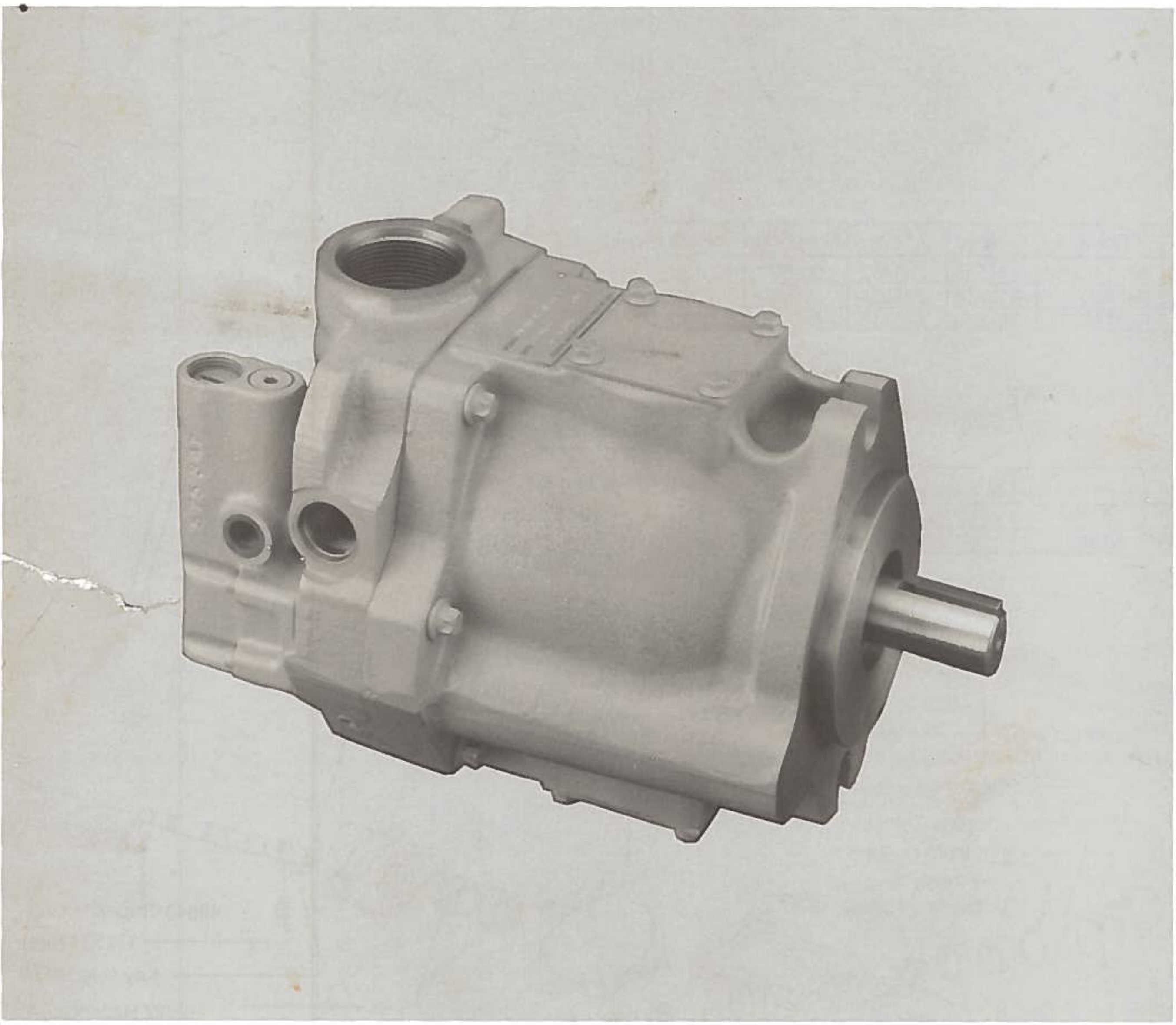
Service Data

VICKERS

25

Low Noise Industrial Piston Pump

PVQ 40–B2/M2 * *** – ** * * – 10 C** *** *** * – 10/11/12/20
PVQ 45–B2/M2 * *** – ** * * – 10 C** *** *** * – 10/11/12/20

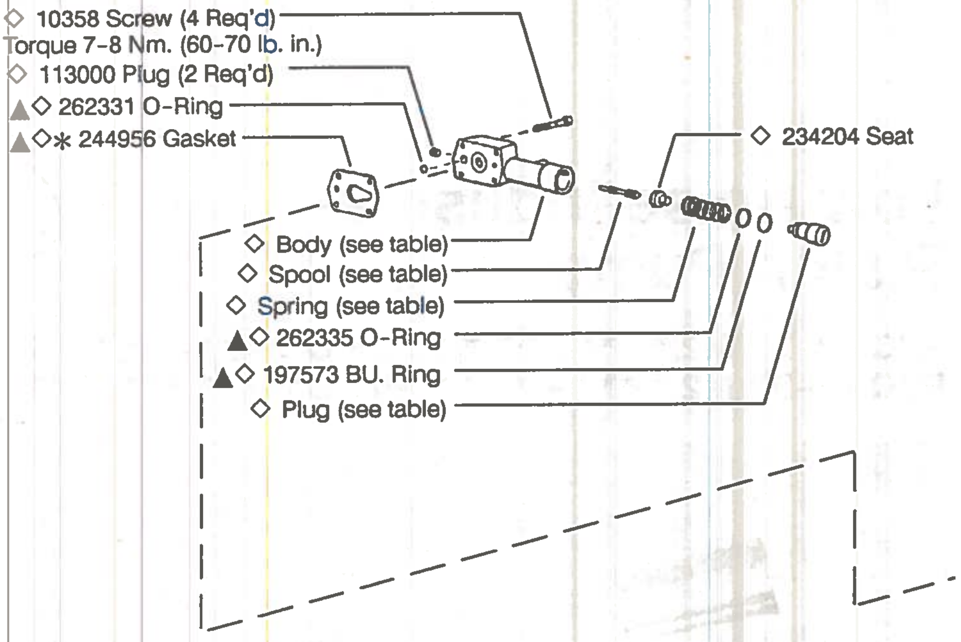


ickers Incorporated
TRINOVA Company
445 Corporate Drive
O. Box 302
oy, Michigan 48007-0302
S.A.

eased 09-01-91

I-3234-S

C, CM Compensator shown for R. H. rotation. Rotate 180° for L. H. shaft rotation.

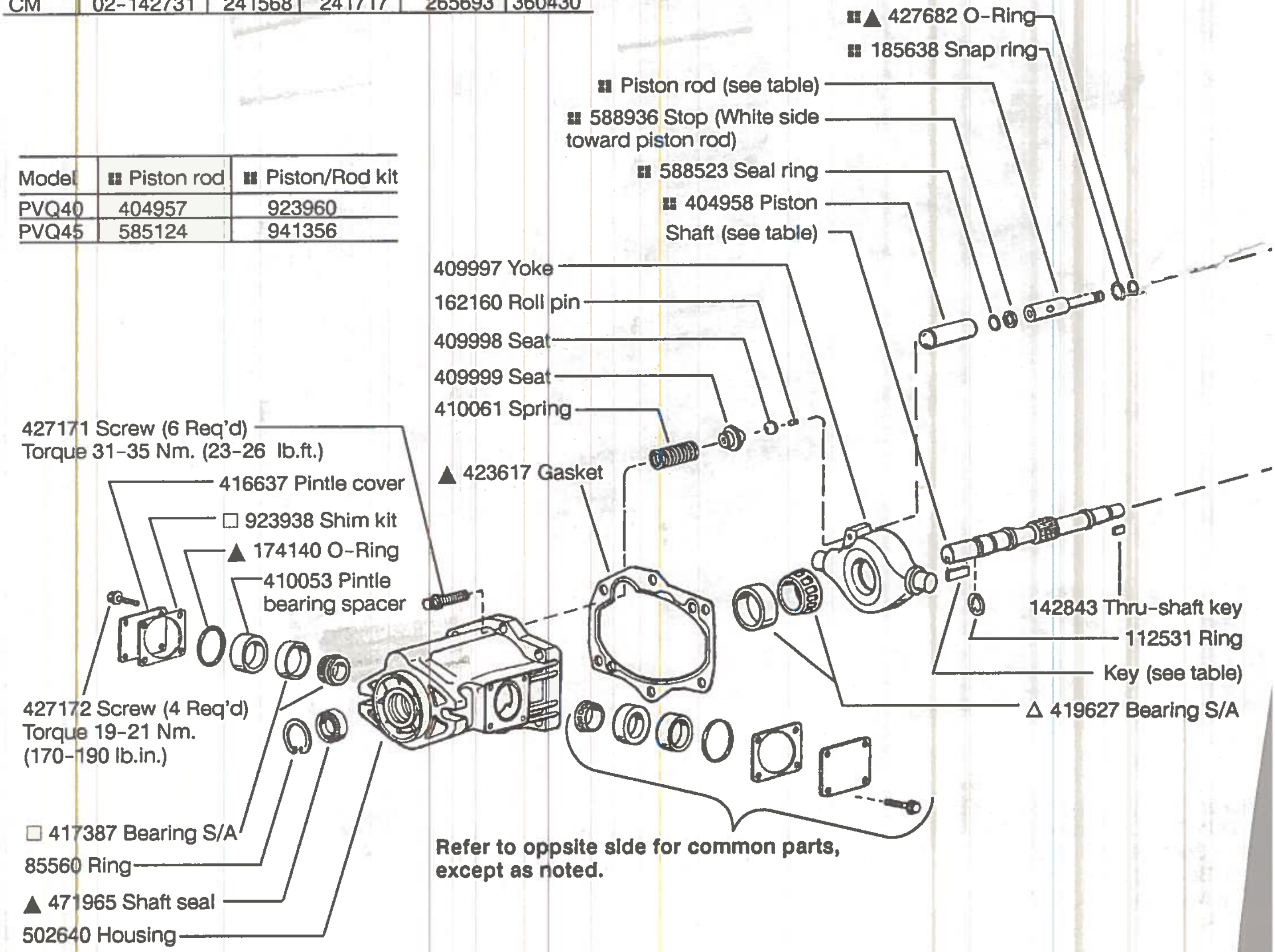


✻ CAUTION

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

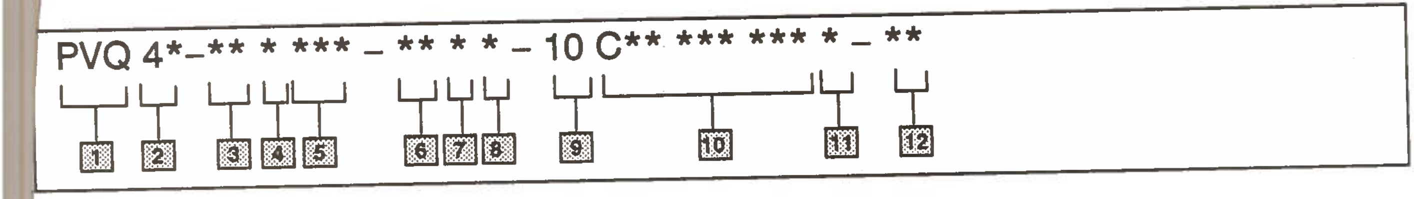
◇ Type	◇ Comp. kit	◇ Body	◇ Spool	◇ Spring	◇ Plug
C	02-142732	241568	241717	239371	360430
CG	942480	412890	296234	239371	412940
CM	02-142731	241568	241717	265693	360430

Model	▪ Piston rod	▪ Piston/Rod kit
PVQ40	404957	923960
PVQ45	585124	941356



Refer to oppsite side for common parts, except as noted.

Model Code



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement

(CC/Rev & Pressure ratings)

40 – 40 CC/Rev (2.50 CIR)
210 bar (3000 psi)
45 – 45 CC/Rev (2.75 CIR)
190 bar (2700 psi)

3 Mounting flange

B2 – SAE "B" 2-bolt
MB – ISO 3019/2 "B" 2-bolt (available with "N" drive shaft only)

4 Rotation

(viewed from shaft end)

R – Right hand (CW) (standard)
L – Left hand (CCW) (optional)

5 Thru drive

(without coupling) Available with side ports only.

Blank – No thru drive
A9 – SAE "A" 2-bolt with 9T shaft
A11 – SAE "A" 2-bolt with 11T shaft
B13 – SAE "B" 2-bolt with 13T shaft
B26 – SAE "B" 2-bolt with 26T shaft
(Available only with #4 main input shaft)

6 Ports

(type and location)

SE – Inch O-Ring boss rear port (standard)
SS – Inch O-Ring boss side port (optional)
FS – Flange side port (SAE "A" thru-drive only)

7 Shafts

(input)

1 – Straight keyed SAE "B"(not on thru drives)
2 – Straight keyed SAE "B-B"
3 – Splined SAE "B" modified 13T, 16/32 DP flat root side fit (not on thru drives)
4 – Splined SAE "B-B" modified 15T, 16/32 DP flat root side fit
N – ISO 3019/2 short straight keyed (available with "MB" mounting only) Not available on thru-drives.
28 – 26 tooth splined shaft (Vickers) Used to mount PVQ40/45 on PVQ40/45 thru-drive pump

8 Seals

S – Buna N (standard)
F – Fluorocarbon (optional)

9 Pump design number

10 – First design

10 Control type

C** – Pressure compensator, PVQ40: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ45: Std. model is C19, indicating factory setting of 190 bar (2750 psi). Range is 02-19 in tens of bar (350-2750 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
CV**B** – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice.
Example: C21V11B indicates PVQ40 compensator with 210 bar pressure setting and 11 bar load sense differential.
CV**P** – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
CVC**B** – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
CVC**P** – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD**** – Electric dual range compensator. PVQ40: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ45: Std. model is CD1910, indicating settings of 190 and 100 bar, adjustment ranges are 20-190 bar (high) and 20-100 bar (low).

11 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

12 Control design

10 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

CAUTION
Model PVQ45C compensator pressure adjustment shall not exceed 2000 psi

10 NOTE: See model code for pressure range settings of individual compensator kits.

Model	◆ Comp. kit	◆ Comp. Spring	◆ Load Sense Spring
PVQ**C	02-142732	239371	———
PVQ**CM	02-142731	265693	———
PVQ**CG	942480	239371	———
PVQ**F/WCG	941353	265693	———
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

Model	Shaft end rotation	Wafer plate	Valve block	Thru-Drive valve block	O-Ring
PVQ45*R*SS	Right hand (CW)	629539	429729	———	———
PVQ40*R*SS					
PVQ45*R*SE			585127	———	
PVQ40*R*SE					
PVQ45*L*SS	Left hand (CCW)	631476	586133	———	
PVQ40*L*SS					
PVQ45*L*SE			585129	———	
PVQ40*L*SE					
PVQ4**RAFS	Right hand (CW)	629539	———	857668	351776
PVQ4**RBSS			———	627149	375422
PVQ4**LAFS	Left hand (CCW)	631476	———	568082	351776
PVQ4**LBSS			———	627541	375422

Thru-Drive Shafts

5 Model	Shaft	7 Input Type
PVQ**A9	883098	2 Str. Keyed SAE B-B
	586131	4 Splined SAE B-B
PVQ**B26	677131	2 Str. Keyed SAE B-B
	423416	4 Splined SAE B-B

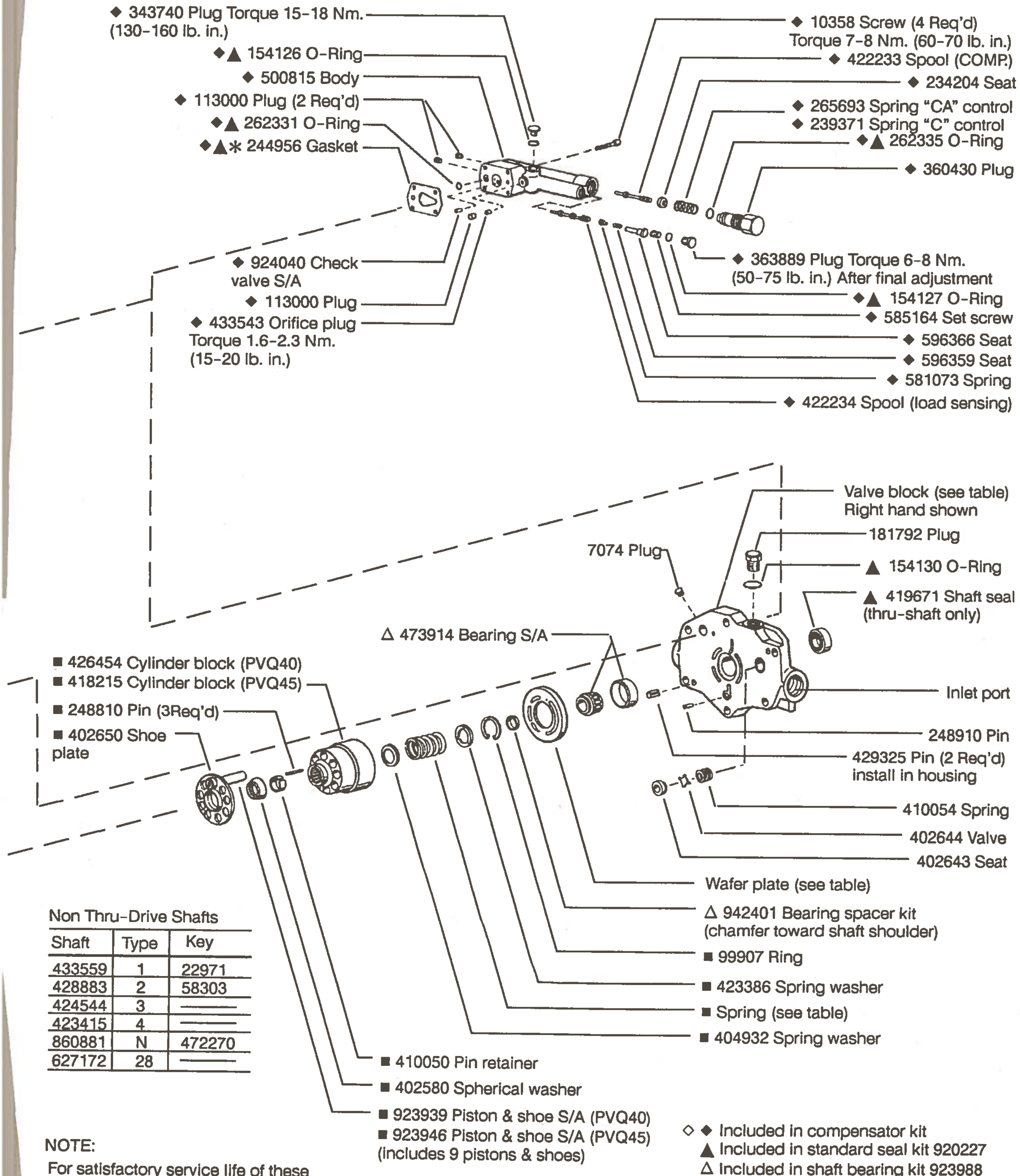
Thru-Drive Couplings

Thru-Drive Model Code	Coupling	O-Ring	Model Code Rear Pump	Rear Pump Shaft Type
PVQ**A9	864224	351776	PVQ10	3
			V10	11
			V20	62
PVQ**B26	627168	375422	PVE12	28
			PVQ40/45	28
			PVQ20/32	28
	475134		2520V	166

Rear pump, couplings, O-rings, capscrews and washers must be ordered separately to mount rear pump.

Thru-Drive Couplings	Type	Discription
864224	A	"A" 9 tooth spline
627168	B	26 tooth
475134	B	Step coupling 26 to 15 tooth "B-B" spline

CVP Compensator shown for R. H. rotation. Rotate 180° for L. H. shaft rotation. See table for compensator kit part number.


◆ 343740 Plug Torque 15-18 Nm. (130-160 lb. in.)
◆▲ 154126 O-Ring
◆ 500815 Body
◆ 113000 Plug (2 Req'd)
◆▲ 262331 O-Ring
◆▲✱ 244956 Gasket
◆ 924040 Check valve S/A
◆ 113000 Plug
◆ 433543 Orifice plug Torque 1.6-2.3 Nm. (15-20 lb. in.)
◆ 10358 Screw (4 Req'd) Torque 7-8 Nm. (60-70 lb. in.)
◆ 422233 Spool (COMP.)
◆ 234204 Seat
◆ 265693 Spring "CA" control
◆ 239371 Spring "C" control
◆▲ 262335 O-Ring
◆ 360430 Plug
◆ 363889 Plug Torque 6-8 Nm. (50-75 lb. in.) After final adjustment
◆▲ 154127 O-Ring
◆ 585164 Set screw
◆ 596366 Seat
◆ 596359 Seat
◆ 581073 Spring
◆ 422234 Spool (load sensing)
Valve block (see table) Right hand shown
181792 Plug
7074 Plug
▲ 154130 O-Ring
▲ 419671 Shaft seal (thru-shaft only)
△ 473914 Bearing S/A
■ 426454 Cylinder block (PVQ40)
■ 418215 Cylinder block (PVQ45)
■ 248810 Pin (3Req'd)
■ 402650 Shoe plate
Inlet port
248910 Pin
429325 Pin (2 Req'd) install in housing
410054 Spring
402644 Valve
402643 Seat
Wafer plate (see table)
△ 942401 Bearing spacer kit (chamfer toward shaft shoulder)
■ 99907 Ring
■ 423386 Spring washer
■ Spring (see table)
■ 404932 Spring washer
■ 410050 Pin retainer
■ 402580 Spherical washer
■ 923939 Piston & shoe S/A (PVQ40)
■ 923946 Piston & shoe S/A (PVQ45) (includes 9 pistons & shoes)

Non Thru-Drive Shafts

Shaft	Type	Key
433559	1	22971
428883	2	58303
424544	3	———
423415	4	———
860881	N	472270
627172	28	———

NOTE:

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

Model	■ Spring	Color
PVQ40	632570	Yellow
PVQ45	402579	Red

◇ ◆ Included in compensator kit
▲ Included in standard seal kit 920227
△ Included in shaft bearing kit 923988
□ Included in yoke bearing kit 923987
■ Rotating group kit 923948 (PVQ40)
■ Rotating group kit 923947 (PVQ45)

MODEL CODE BREAKDOWN

V10-(P)* * * * - * * (*)-(*) 20- * * *L

VANE PUMP

SERIES
10 OR 20

F - FLOW CONTROL COVER
P - PRIORITY VALVE COVER
OMITTED - STD. COVER

MOUNTING
1-2 BOLT FLANGE (SAE "A" SIZE)
2-FOOT BRACKET AT 12 O'CLOCK
(VIEWED FROM THE SHAFT END)
23-FOOT BRACKET AT 3 O'CLOCK
26-FOOT BRACKET AT 6 O'CLOCK
29-FOOT BRACKET AT 9 O'CLOCK

INLET PORT		
CODE	MODEL	SIZE
E	V20	1.5"Dia. -2 BOLT FLG.
F		1.156"Dia. -2 BOLT FLG.
H	V10	1" O.D. TUBE CONN.
K		1.3125"-12 UN2B THD.
P		1" N.P.T.F.
	V20	1.25" N.P.T.F.
R		1" N.P.T.F.
S	V10	1.3125"-12 STR. THD.
	V20	1.625"-12 UN2B THD.
T	V10	1.1875"-12 STR. THD.

RING CAPACITY-1200 RPM-100PSI

(V10)	(V20)
1 - 1 USGPM	6 - 6 USGPM
2 - 2 USGPM	~~7 - 7~~ USGPM
3 - 3 USGPM	8 - 8 USGPM
4 - 4 USGPM	9 - 9 USGPM
5 - 5 USGPM	11 - 11 USGPM
6 - 6 USGPM	12 - 12 USGPM
7 - 7 USGPM	13 - 13 USGPM

FOR LEFT HAND ROTATION
VIEWED FROM SHAFT END

SPECIAL FEATURE SUFFIX

DESIGN & MODIFICATION
V10-10 V20(F)-11
V10(F)-20 V20P-11/12

PRESSURE SETTING
A-250 PSI
B-500 PSI
C-750 PSI
D-1000 PSI
E-1250 PSI
F-1500 PSI
G-1750 PSI
H-2000 PSI
J-2250 PSI
K-2500 PSI

FLOW RATE THROUGH
ORIFICE IN COVER
2-2 GPM
3-3 GPM (V10F ONLY)
4-4 GPM
5-5 GPM (V10F ONLY)
6-6 GPM
7-7 GPM (V10F ONLY)
8-8 GPM (V20F ONLY)

PRESSURE PORT POSITIONS
VIEW FROM COVER END
A-OPPOSITE INLET
CONNECTION.
B- 90° COUNTERCLOCKWISE
FROM INLET CONNECTION
C-INLINE WITH INLET
D-90° CLOCKWISE FROM INLET
CONNECTION

SHAFTS
1-STR. KEYED
3-THD.
4-THD.
6-STR. STUB-KEYED
11-SPLINE-9 TOOTH
12-SPLINE-13 TOOTH
15-SPLINE-13 TOOTH
27-TANG
34-THD.
38-SPLINE-11 TOOTH

				OUTLET PORT CONNECTIONS		
		FLOW CONTROL COVER		PRIORITY VALVE COVER		
CODE	STANDARD COVER	PRESSURE	TANK	PRIMARY OUTLET	SECONDARY OUTLET	TANK
K	——	——	——	9/16-18 ST. THD. (V10P)	3/4-16 ST. THD. (V10P)	9/16-18 ST. THD. (V10P)
P	1/2 IN. NPT THD. (V10 ONLY)	3/4-16 ST. THD.	1/2 IN. NPT THD.	——	——	——
	3/4 IN. NPT THD. (V20 ONLY)	V10F AND V20F	V10F AND V20F	——	——	——
S	3/4-16 ST. THD.	——	——	——	——	——
	1 1/16-12 ST. THD. (V20 ONLY)	3/4-16 ST. THD. (V20F)	1 1/16-12 ST. THD. (V20F)	——	——	——
T	——	3/4-16 ST. THD. (V10F)	3/4-16 ST. THD. (V10F)	3/4-16 ST. THD. (V20P)	7/8-14 ST. THD. (V20P)	3/4-16 ST. THD. (V20P)

Section II - DESCRIPTION

A. GENERAL

Pumps in this series are used to develop hydraulic fluid flow for the operation of Mobile and Industrial equipment. The positive displacement pumping cartridges are the rotary vane type with shaft side loads hydraulically balanced. The flow rate depends on the pump size and the speed at which it is driven.

All units are designed so that the direction of rotation, pumping capacity and port positions can be readily changed to suit particular applications.

B. ASSEMBLY AND CONSTRUCTION

The V10 series pump illustrated in the cut-a-way of Figure 1 is representative of all single pumps in this series. The unit consists principally of a ported body, a ported cover and a pumping cartridge. Components of the pumping cartridge are an elliptical cam ring, a slotted rotor splined to fit the drive shaft and twelve vanes fitted to the rotor slots.

The pumping cartridge cam ring is sandwiched between the body and cover. A ball bearing and bushing located in the body and pressure plate respectively support each end of the drive shaft and center the rotor within the cam ring. As the drive shaft is driven by the prime mover, the rotor and vanes generate flow by carrying fluid around the elliptical cam ring contour. Fluid enters the cartridge through the inlet port in the body and is discharged through the pressure plate into the outlet port of the cover.

C. FLOW CONTROL AND RELIEF VALVE

V10 and V20 pumps are available with an integral Flow Control and Relief Valve in the pump cover. This limits the fluid flow in the system to a maximum prescribed rate and prevents excessive pressure build-up. Fluid not required in the system is recirculated to tank.

D. PRIORITY VALVE

V10 and V20 pumps are also available with a priority valve located in the pump cover. The priority valve maintains nearly a constant flow to a primary circuit and diverts the remaining flow to a secondary circuit. Flow going to the secondary circuit is determined by pump delivery. The primary circuit is protected by an integral relief valve but an external relief valve must be provided for the secondary circuit.

E. APPLICATION

Pump ratings in GPM as shown in the model coding are at 1200 RPM and 100 PSI. For ratings at other speeds, methods of installation and other application information, Vickers Application Engineering personnel should be consulted.

Section III - PRINCIPLES of OPERATION

A. PUMPING CARTRIDGE

As mentioned in Section II, fluid flow is developed by the pumping cartridge. The action of the cartridge is illustrated in Figure 2. The rotor is driven within the cam ring by the driveshaft, which is coupled to a power source. As the rotor turns, centrifugal force causes the vanes to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet sections of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers. (Fluid outside the inlet is at atmospheric pressure or higher.)

This fluid is trapped between the vanes and carried

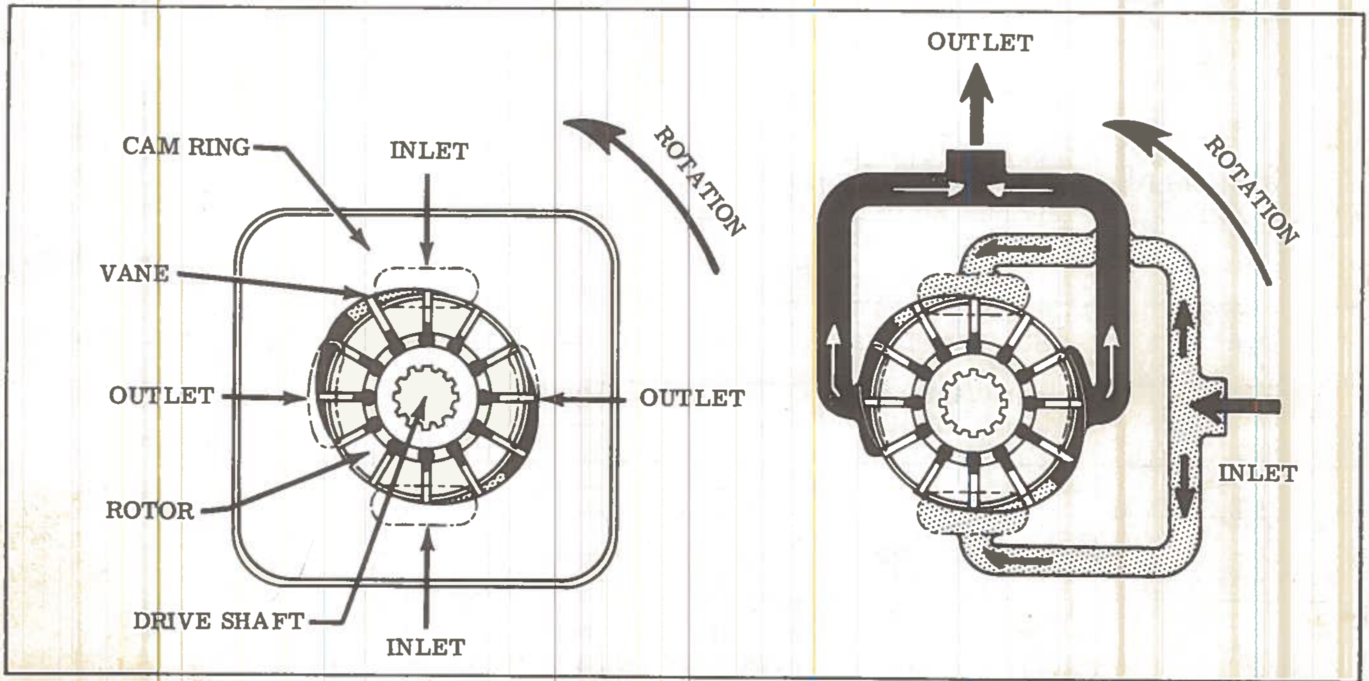


Figure 2

past the large diameter or dwell section of the cam ring. As the outlet section is approached, the cam ring diameter decreases and the fluid is forced out into the system. System pressure is fed under the vanes, assuring their sealing contact against the cam ring during normal operation.

B. HYDRAULIC BALANCE

The pump cam ring is shaped so that the two pumping chambers are formed diametrically opposed. Thus, hydraulic forces which would impose side loads on the shaft are cancelled.

C. PRESSURE PLATE

The pressure plate seals the pumping chamber as shown in Figure 3. A light spring holds the plate against the cartridge until pressure builds up in the system. System pressure is effective against the area at the back of the plate, which is larger than the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes.

D. FLOW CONTROL AND RELIEF VALVE

1. Maximum flow to the operating circuit and maximum system pressure are determined by the integral flow control and relief valve in a special outlet cover used on some V10 and V20 pumps. This feature is illustrated pictorially in Figure 4. An orifice in the cover limits maximum flow. A pilot-operated type relief valve shifts to divert excess fluid delivery to tank, thus limiting the system pressure to a predetermined maximum.

2. Figure 4A shows the condition when the total pump delivery can be passed through the orifice.

This condition usually occurs only at low drive speeds. The large spring chamber is connected to the pressure port through an orifice. Pressure plus spring load in this chamber slightly exceeds pressure at the other end of the relief valve spool and the spool remains closed. Pump delivery is blocked from the tank port by the spool land.

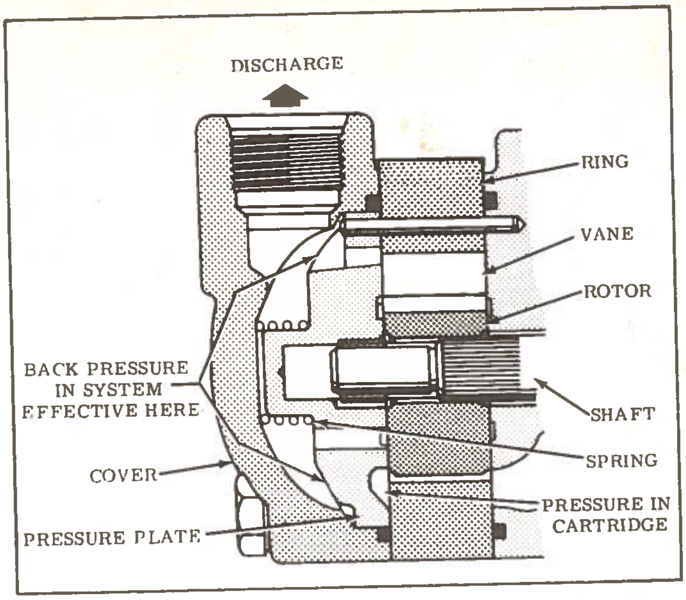
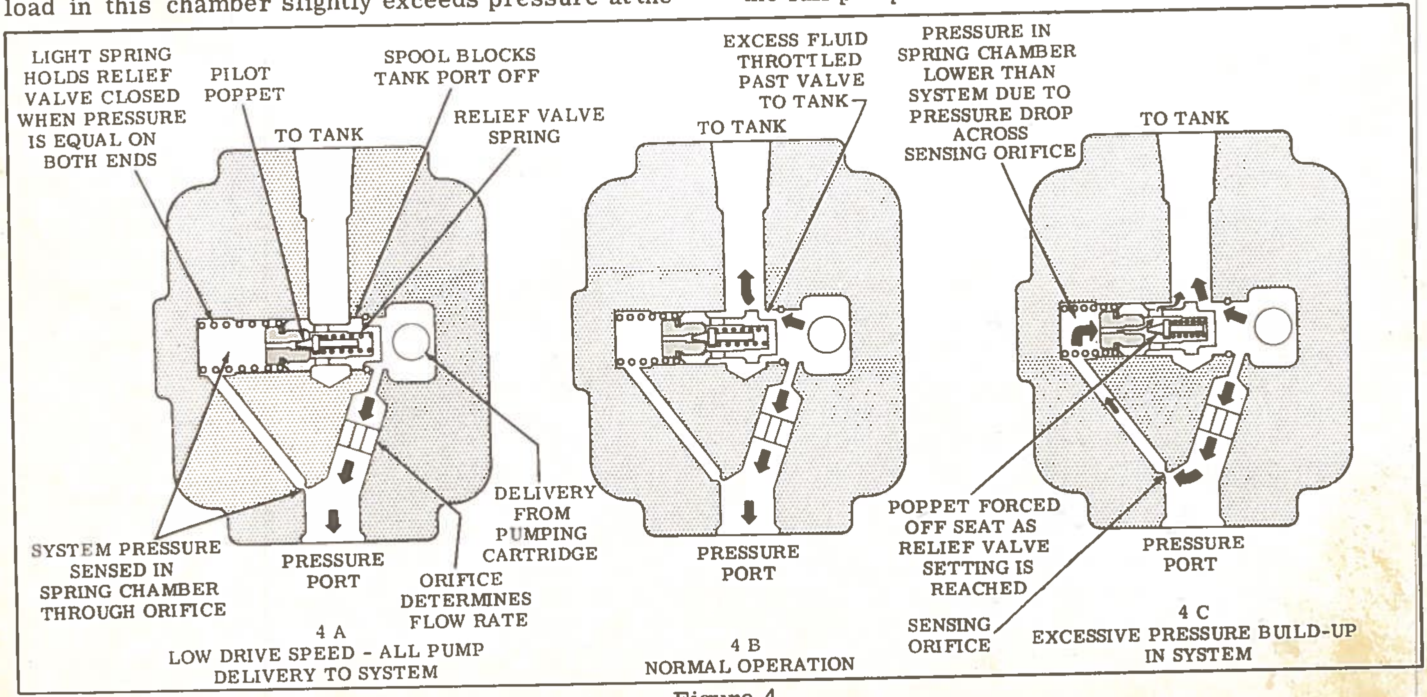


Figure 3

3. When pump delivery is more than the flow rate determined by the orifice plug, pressure builds up across the orifice and forces the spool open against the light spring. Excess fluid is throttled past the spool to the tank port as shown in Figure 4B.

4. If pressure in the system builds up to the relief valve setting (Figure 4C), the pilot poppet is forced off its seat. Fluid in the large spring chamber flows through the spool and out to tank. This flow through the small sensing orifice, causes a pressure drop and prevents pressure in the large spring area from increasing beyond the relief valve setting. As pressure against the right end of the spool starts to exceed the relief valve setting, the pressure differential forces the spool to the left, against the light spring, porting the full pump flow to tank.


LIGHT SPRING HOLDS RELIEF VALVE CLOSED WHEN PRESSURE IS EQUAL ON BOTH ENDS
PILOT POPPET
SPOOL BLOCKS TANK PORT OFF
TO TANK
RELIEF VALVE SPRING
SYSTEM PRESSURE SENSED IN SPRING CHAMBER THROUGH ORIFICE
PRESSURE PORT
ORIFICE DETERMINES FLOW RATE
DELIVERY FROM PUMPING CARTRIDGE
EXCESS FLUID THROTTLED PAST VALVE TO TANK
TO TANK
PRESSURE PORT
PRESSURE IN SPRING CHAMBER LOWER THAN SYSTEM DUE TO PRESSURE DROP ACROSS SENSING ORIFICE
TO TANK
POPPET FORCED OFF SEAT AS RELIEF VALVE SETTING IS REACHED
SENSING ORIFICE
PRESSURE PORT

4 A
LOW DRIVE SPEED - ALL PUMP DELIVERY TO SYSTEM

4 B
NORMAL OPERATION

4 C
EXCESSIVE PRESSURE BUILD-UP IN SYSTEM

Figure 4

E. PRIORITY VALVE OPERATION

Referring to the V20P Cover Schematic, Figure 5, pressure is sensed in cavities "A", "B" and "C". Primary flow into cavity "A" is restricted by the controlled flow orifice "O". Secondary flow will be zero until the pump flow rate through orifice "O" develops a pressure differential across the control spool.

When pump delivery is increased, pressure builds up in cavities "B" and "C" because of the resistance to flow through orifice "O". This causes the spool to shift toward cavity "A" against the spring. The amount of spool shift is proportional to the pressure differential between cavities "A" and "C".

Flow from the primary port is held to an almost constant volume, as determined by orifice "O", and the metering action of the control spool at area "D". Flow to the secondary port varies with pump delivery. Metering area "E" diverts excess flow to the secondary port.

This single spool design cannot give precisely controlled flow to the primary circuit because of the effects of varying conditions of flows and pressures. For example: If the primary circuit is operating at 1000 PSI and the secondary at 100 PSI, the spool must be metering at "E". However, if primary pressure is 100 PSI and secondary is 1000 PSI, the spool must be metering at "D". As the two systems approach the same pressure, the probability of flow fluctuation increases because the spool may shift between these two metering points.

CAUTION

The pump has a built-in relief valve in the primary circuit. However, an external relief valve must be provided for the secondary circuit to protect the pump.

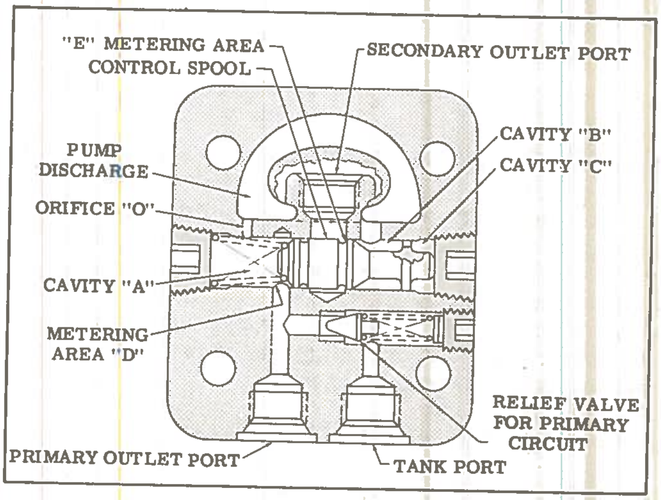


Figure 5

Section IV
INSTALLATION and OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawings listed in Table 1 show the correct installation dimensions and port locations.

B. DRIVE CONNECTIONS

CAUTION

Pump shafts are designed to be installed in couplings, pulleys, etc., with a slip fit or very light tap. Pounding can injure the bearings. Shaft tolerances are shown on the pump installation drawings. (See Table 1.)

1. Direct Mounting - A pilot on the pump mounting flange (Figure 6) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

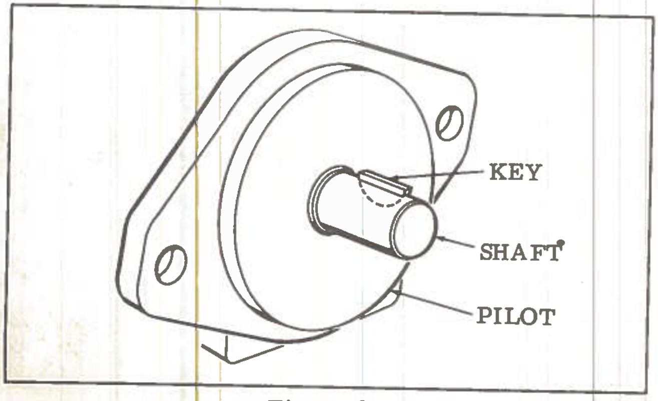


Figure 6

If gaskets are used, they should be installed carefully and should lay flat. Shaft keys and couplings must be properly seated to avoid slipping and possible shearing.

2. Indirect Drive - Chain, spur gear or v-belt pulley drives may also be used with these pumps. Flat belt drives are not recommended because of the possibility of slipping.

To prevent excessive side loads on pump bearings, it is important to check for correct alignment and guard against excessive belt or chain tension.

For best results on indirect drive applications, use the largest permissible pully diameter at the pump and position it close as possible to the pump mounting face. For specific indirect drive application data, contact your Vickers Application Engineer.

C. SHAFT ROTATION

Pumps are normally assembled for right-hand (clockwise) rotation as viewed from the shaft end. A pump made for left-hand rotation is identified by an "L" in the model code (See Table 2).

NOTE

These pumps must be driven in the direction of the arrows cast on the pump ring. If it is desired to change the direction of drive rotation, it is necessary to reverse the ring. (See Section VI-B-D and Figure 10.)

CAUTION

Never drive a pump in the wrong direction of rotation. Seizure may result, necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sand blasting, wire brushing and pickling.

NOTE

For instructions on pickling refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheets for oil selection are available from Vickers,Inc. Technical Publications, Troy, MI. 48084.

For Industrial Applications order data sheet I-286-S. For Mobile Applications order M-2950-S.

The oil recommendations noted in the data sheets are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Vickers representative.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

A. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

B. Filter each change of oil to prevent introduction of contaminants into the system.

C. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

D. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

E. During usage, proper oil filling and servicing of filters, breathers, reservoirs, etc., cannot be over emphasized.

F. Thorough precautions should be taken, by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. Contaminated fluids can cause excessive wear of internal pump parts which may result in increased sound levels.

F. OVERLOAD PROTECTION

A relief valve must be installed in the system, unless it is an integral part of the pump. The relief valve limits pressure in the system to a prescribed maximum and protects the components from excessive pressure. The setting of the relief valve depends on the work requirements of the system components.

G. PORT POSITIONS

The pump cover can be assembled in four positions with respect to the body. A letter in the model

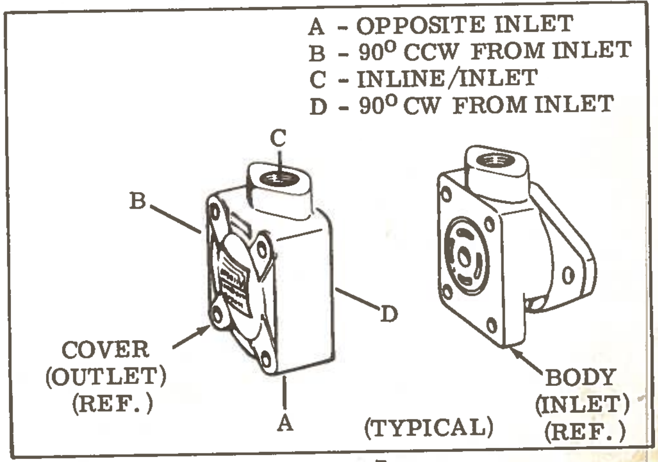


Figure 7

code (Table 2) identifies the cover position as shown in Figure 7.

Disassembly and assembly procedures are in Section VI-B and D.

H. START-UP

With a minimum drive speed of 600 RPM, a pump should prime almost immediately, if provision is made to initially purge the air from the system. Failure to prime within a reasonable length of time may result in damage due to lack of lubrication. Inlet lines must be tight and free from air leaks. However, it may be necessary to crack a fitting on the outlet side of the pump to purge entrapped air.

Section V
SERVICE, INSPECTION AND MAINTENANCE

A. SERVICE TOOLS

No special tools are required to service these pumps.

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly.

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system, resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants.
   If the fluid becomes contaminated the system should be thoroughly drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer).

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutions may result in early failure. Part numbers are shown in the parts catalogs listed in Table 1.

G. TROUBLE-SHOOTING

Table 6 lists the common difficulties experienced with vane pumps and hydraulic systems. It also indicates the probable causes and remedies for each of the troubles listed.

It should always be remembered that many apparent pump failures are actually the failures of other parts of the system. The cause of improper operation is best diagnosed with adequate testing equipment and a thorough understanding of the complete hydraulic system.

Section VI - OVERHAUL

WARNING

> Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure.

A. GENERAL

Plug all removed units and cap all lines to prevent the entry of dirt into the system. During disassembly, pay particular attention to identification of the parts, especially the cartridges, for correct assembly.

Pump bearings are pressed in the bodies or on the shafts and should not be removed unless defective. Figure 8 is an exploded view which shows the proper relationship of the parts for disassembly and assembly. Refer to Figure 1 and Figure 8 for the correct assembled relationship of the parts.

B. DISASSEMBLY

1. Disassembly of Basic Pump-See Figure 8. If a foot bracket is used, remove before dismantling the pump. Clamp the pump body in a vise (not too

TABLE 6 - TROUBLE SHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
PUMP NOT DELIVERING FLUID	DRIVEN IN THE WRONG DIRECTION OF ROTATION	The drive direction must be changed immediately to prevent seizure. Figure 10 shows the correct ring position for each direction of rotation.
	COUPLING OR SHAFT SHEARED OR DISENGAGED	Disassemble the pump and check the shaft and cartridge for damage. (See Section VI.) Replace the necessary parts.
	FLUID INTAKE PIPE IN RESERVOIR RESTRICTED	Check all strainers and filters for dirt and sludge. Clean if necessary.
	FLUID VISCOSITY TOO HEAVY TO PICK UP PRIME	Completely drain the system. Add new filtered fluid of the proper viscosity.
	AIR LEAKS AT THE INTAKE. PUMP NOT PRIMING	Check the inlet connections to determine where air is being drawn in. Tighten any loose connections. See that the fluid in the reservoir is above the intake pipe opening. Check the minimum drive speed which may be too slow to prime the pump.
	RELIEF VALVE STUCK OPEN. (MODELS WITH INTEGRAL RELIEF VALVE ONLY)	Disassemble the pump and wash the valve in clean solvent. Return the valve to its bore and check for any stickiness. A gritty feeling on the valve periphery can be polished with crocus cloth. Do not remove excess material, round off the edges of the lands or attempt to polish the bore. Wash all parts and reassemble the pump.
	VANE(S) STUCK IN THE ROTOR SLOT(S)	Disassemble the pump. Check for dirt or metal chips. Clean the parts thoroughly and replace any damaged pieces. If necessary flush the system and refill it with clean fluid.
INSUFFICIENT PRESSURE BUILD-UP	SYSTEM RELIEF VALVE SET TOO LOW	Use a pressure gage to correctly adjust the relief valve.
	COMPLETE LOSS OF FLOW FROM PUMP.	-A valve is stuck open permitting free flow to tank. -Broken inlet or pressure line. -Actuator bypassing the full flow. (Motor valve plate lift)
PUMP MAKING NOISE	PUMP INTAKE PARTIALLY BLOCKED	Service the intake strainers. Check the fluid condition and, if necessary, drain and flush the system. Refill with clean fluid.
	AIR LEAKS AT THE INTAKE OR SHAFT SEAL. (OIL IN RESERVOIR WOULD PROBABLY BE FOAMY)	Check the inlet connections and seal to determine where air is being drawn in. Tighten any loose connections and replace the seal if necessary. See that the fluid in the reservoir is above the intake pipe opening.
	PUMP DRIVE SPEED TOO SLOW OR TOO FAST	Operate the pump at the recommended speed.
	COUPLING MISALIGNMENT	Check if the shaft seal bearing or other parts have been damaged. Replace any damanged parts. Realign the coupled shafts.

tightly), cover end up, and remove the four cover screws. Note the position of the cover port with respect to the body port before lifting off the cover and "O" ring. (See paragraph 2 for disassembly of flow control covers and paragraph 3 for disassembly of the priority valve covers).

Remove the pressure plate and spring. Note the position of the ring for correct reassembly. Lift off the ring and remove the locating pins. Separate the vanes from the rotor and remove the rotor from the shaft.

Turn the pump body over then remove the shaft key and the snap ring which retains the bearing. Tap with a soft hammer on the splined end of the shaft to force the shaft out of the body. Remove the small snap ring, located on the shaft, behind the bearing. Support the bearing inner race and press the shaft out of the bearing. Pull the shaft seal out of the body with a suitable hooked tool.

CAUTION

Do not disassemble the relief valve S/A removed in the following step. The unit is factory set and could malfunction if disassembled.

2. Disassembly of Flow Control and Relief Valve Covers - See Figure 8. Remove the plug (and "O"ring latest design V10 models) from the snap ring side of the cover. Then remove the plug (and "O"ring latest design V10 models), that releases the spring and relief valve S/A. Insert a suitable tool from the snap ring end of the bore. Slide the relief valve S/A from the cover. Remove the snap ring with care - DO NOT scratch the bore.

3. Disassembly of the Priority Valve Cover - See Figure 8. Remove the plug (and "O"ring latest design V10/V20 models)and spring from one end of the priority valve bore, and the plug (and "O"ring latest design V10/V20 models) from the other end of the bore. Insert a suitable tool into the snap ring end of the bore (Snap ring used with pipe thread plugs only) and slide the priority valve spool from the cover. If the snap ring exists, remove it from the cover. Disassemble the relief valve by removing the plug spring poppet and shims. On later designs, a spring guide is used. See Figure 8. DO NOT remove the seat unless inspection of the poppet contact area reveals a problem in the seat area. If removal of the seat is required, thread the seat with a suitable tap approximately 3/8 inch into the seat. Thread a long bolt into the seat and pull the bolt and seat from the bore with a small gear puller.

C. INSPECTION AND REPAIR

CLEANING. All parts must be throughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement more stringent than usual. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning spools, orifices, and cover passages.

1. Discard the used shaft seal and all "O" rings. Wash the metal parts in a solvent, blow them dry with filtered compressed air and place them on a clean surface for inspection.

2. Check the wearing surfaces of the body, pressure plate, ring and rotor for scoring and excessive wear. Remove light score marks by lapping. Replace any heavily scored or badly worn parts.

3. Inspect the vanes for burrs, wear and excessive play in the rotor slots. Replace the vanes and rotor if the slots are worn.

4. Check the bearings for wear and looseness. Rotate the bearings while applying pressure to check for pitted or cracked races.

5. Inspect the oil seal mating surface on the shaft for scoring or wear. If marks on the shaft cannot be removed by light polishing, replace the shaft.

6. Flow Control Cover: Check the relief valve sub-assembly for free movement in the cover bore. Remove burrs from the valve by polishing, but DO NOT round off the corners of the lands. Do not attempt to rework the valve bore. If the bore is damaged, replace the cover.

7. Priority Valve Cover: Inspect the priority valve spool and bore for burrs. Remove burrs from the spool by light polishing with crocus or # 500 grit paper. DO NOT round off sharp corners of the lands. Inspect the cover bore for scratches, wear and/or a pitted surface. DO NOT attempt to rework the bore. If the bore is damaged, replace the cover. The priority valve spool must fit and move within the bore without evidence of bind. Rotate the spool through 360° while inspecting for bind. Inspect the snap ring for damage. (V20 units only). If worn or bent, replace with a new snap ring. If the snap ring is bent, inspect the snap ring groove in the cover for sufficient depth and rounded edges of the snap ring groove. If the groove is defective, replace the cover.

Integral Relief Valve: Inspect the spring. The spring ends must be paralled to prevent cocking of the poppet. The poppet requires a close inspection in the seat contact area. A slight wear pattern should exist around the poppet at the area of seat contact. If the wear pattern is broken, a possible leakage path exists between the poppet and seat. Inspect the seat for possible errosion or other defects. Refer to the seat removal procedure if the seat is defective. (Paragraph VI. B. 3)

D. ASSEMBLY

Coat all parts with hydraulic fluid to facilitate assembly and provide initial lubrication. Use small amounts of petroleum jelly to hold "O" rings in place during assembly.

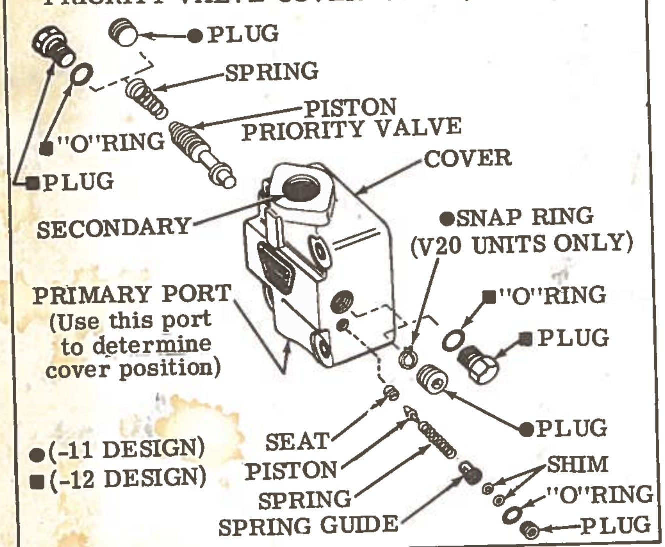
IMPORTANT

During handling and shipping of the precision machined cartridge parts, it is possible to raise burrs on the sharp edges. All sharp edges on the parts of a new cartridge kit should be stoned prior to installation.

1. Assembly of Flow Control Cover - See Figure 8. Assemble the snap ring in place within the bore, (early design only) seat firmly in the groove. Insert the valve in the bore, small land first. Then install the spring and both plugs. Use new "O"rings if straight thread plugs are used.

2. Assembly of priority valve cover - See Figure 8. If the relief valve seat was removed, a new seat must be pressed into the body. Lubricate and insert the new seat chamfered end first into the cover open-

PRIORITY VALVE COVER V10-10/V20-11/-12



NOTE: Priority Cover Information:

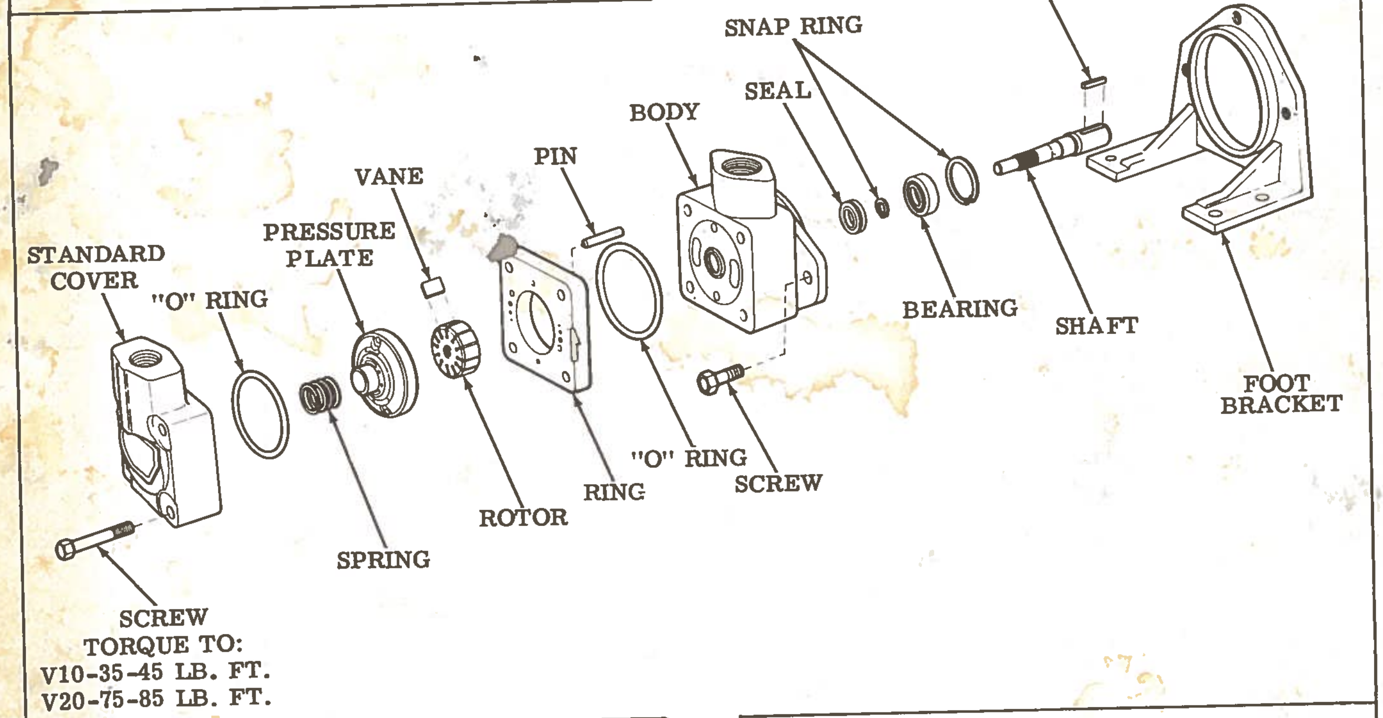
V10-10 early models and V20-11 models use pipe threaded plugs.

V10-10 current design and V20-12 models use straight threaded plugs and "O"ring seals.

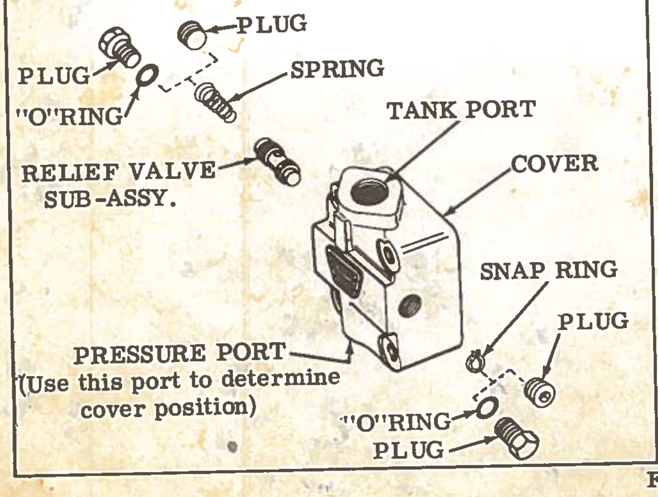
Flow Control Cover Information:

V10-20 early models and V20-11 models use pipe threaded plugs.

V10-20 current design uses straight threaded plugs with "O"rings. The V20-11 is the current design and still uses pipe threaded plugs.



FLOW CONTROL VALVE COVER



SECTIONAL VIEW

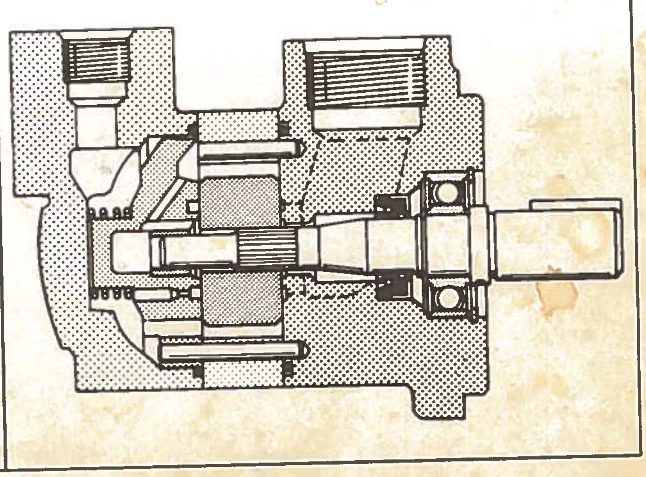


Figure 8

ing. Align square and press into place. Use a short length of brass rod as a pressing tool, to prevent seat damage. Clean the relief valve bore to remove chips and filings. Insert the poppet into the bore, align square and lightly tap the stem of the poppet to mate the poppet and seat. Install the spring, shims, and plug into the cover. (later design uses a spring guide and straight thread plug with "O"rings) Be sure to check the pressure setting of the relief valve against the model code. If the setting is out of tolerance, readjust by removing or adding shims. (Removing shims reduces pressure while adding shims increases pressure.)

Priority Valve - Install the snap ring within the priority valve cover bore, (early V20 series only); make sure the snap ring is seated within its groove. Insert the priority valve spool, small land first, into the bore. Install plugs at each end of the bore and secure. Refer to Figure 8 for spool orientation.

3. Assembly of Pump - See Figure 8. Begin assembly by pressing the shaft into the front bearing while supporting the bearing inner race. Install the small snap ring on the shaft.

NOTE

Before assembling the shaft seal, determine the correct position of the sealing lip (See Figure 9. Seals are assembled with the garter spring toward the pumping cartridge. Press the seal firmly in place and lubricate the lip with petroleum jelly or other grease compatible with the system fluid. Slide the drive shaft into the body until the bearing is seated. Tap lightly on the end of the shaft if necessary. Install the snap ring.

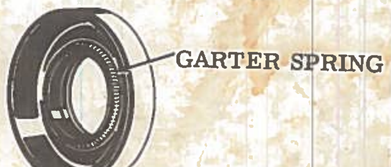
Install new "O" rings in the body and cover. Insert the ring locating pins in the body and assemble the ring so that the arrow on the perimeter points in the direction of rotation. Check the assembly against Figure 10. Install the rotor on the shaft and insert the vanes in the rotor slots. Be certain the radius edges of the vanes are toward the cam ring.

Place the pressure plate on the locating pins and flat against the ring. Place the spring over the pressure plate, and then install the cover with the outlet port in the correct position. Tighten the cover screws to the torque shown in Figure 8. Rotate the shaft by hand to insure that there is no internal binding. Install the shaft key

If a foot mounting is used, assemble the pump to its foot mounting. If a gasket is used, be certain it is flat to avoid misalignment of the shaft.

Section VII - TESTING

If a test stand is available, the pump should be tested at the recommended speeds and pressures shown on the installation drawing. (See Table 1).



SHAFT SEAL
(Assemble with spring toward cover end of pump)

Figure 9

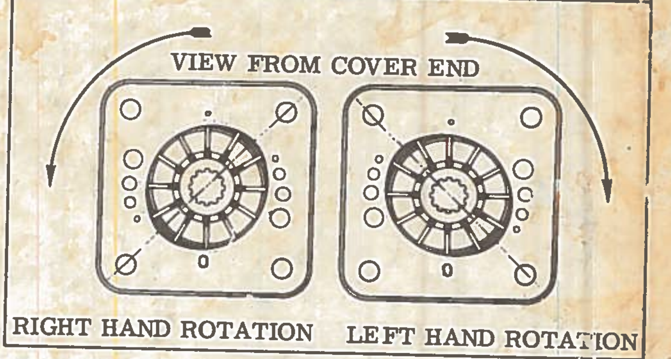
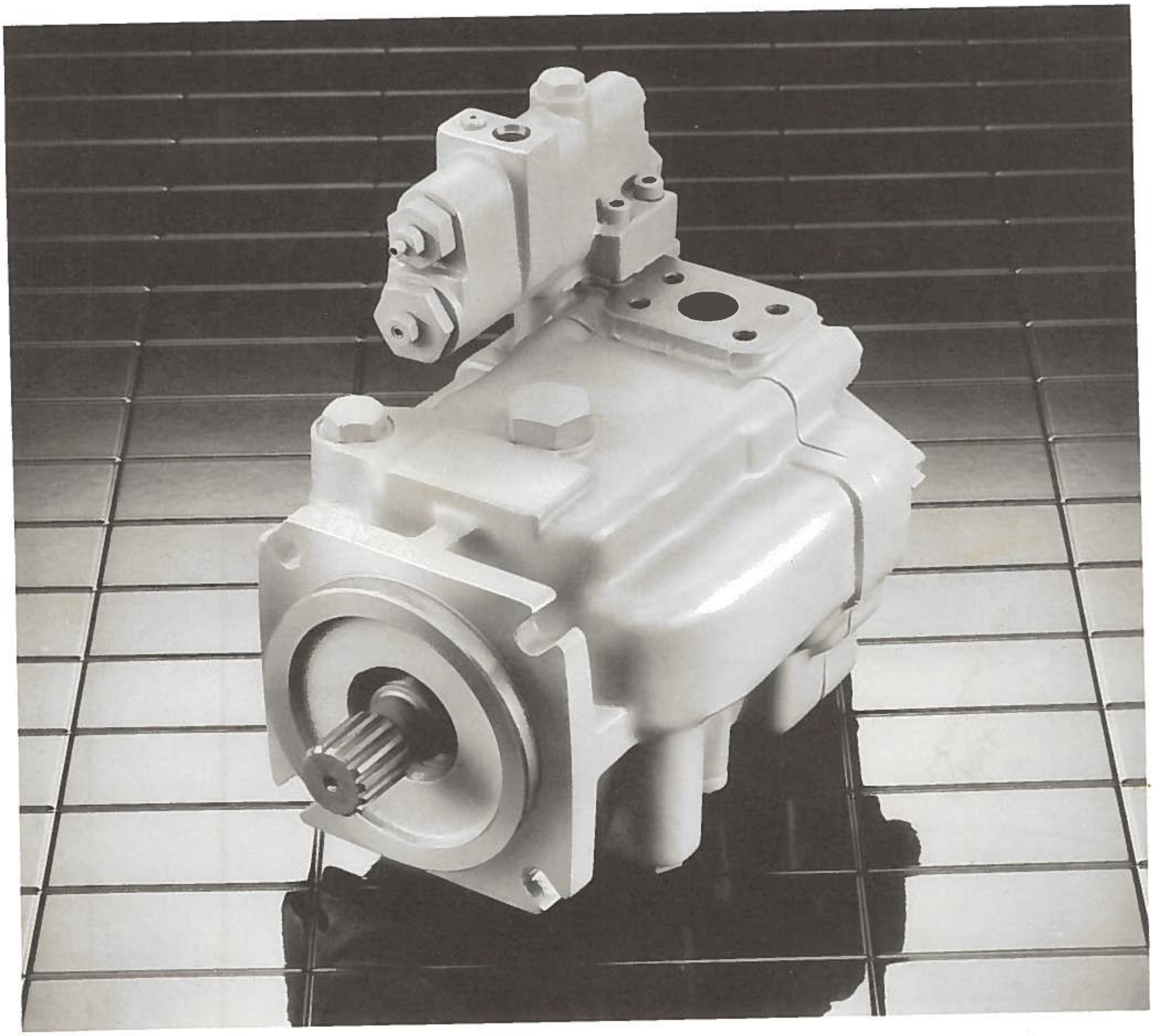


Figure 10

Service Data

VICKERS

PVH98 Variable Displacement Piston Pump

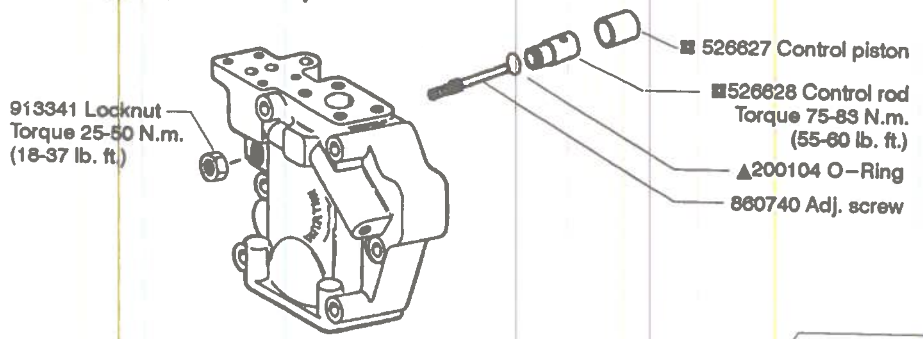


Vickers, Incorporated
A TRINOVA Company
5445 Corporate Drive
P.O. Box 302
Troy, Michigan 48007-0302

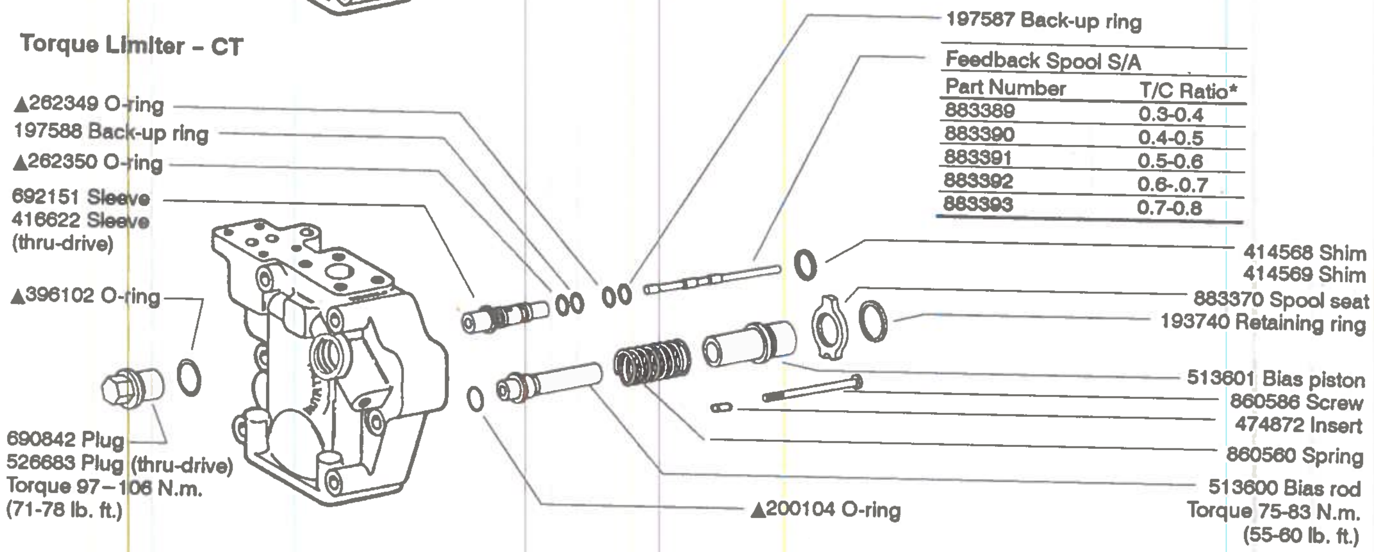
M-2208-S

Revised 12/93

Maximum Adjustable Stop - S



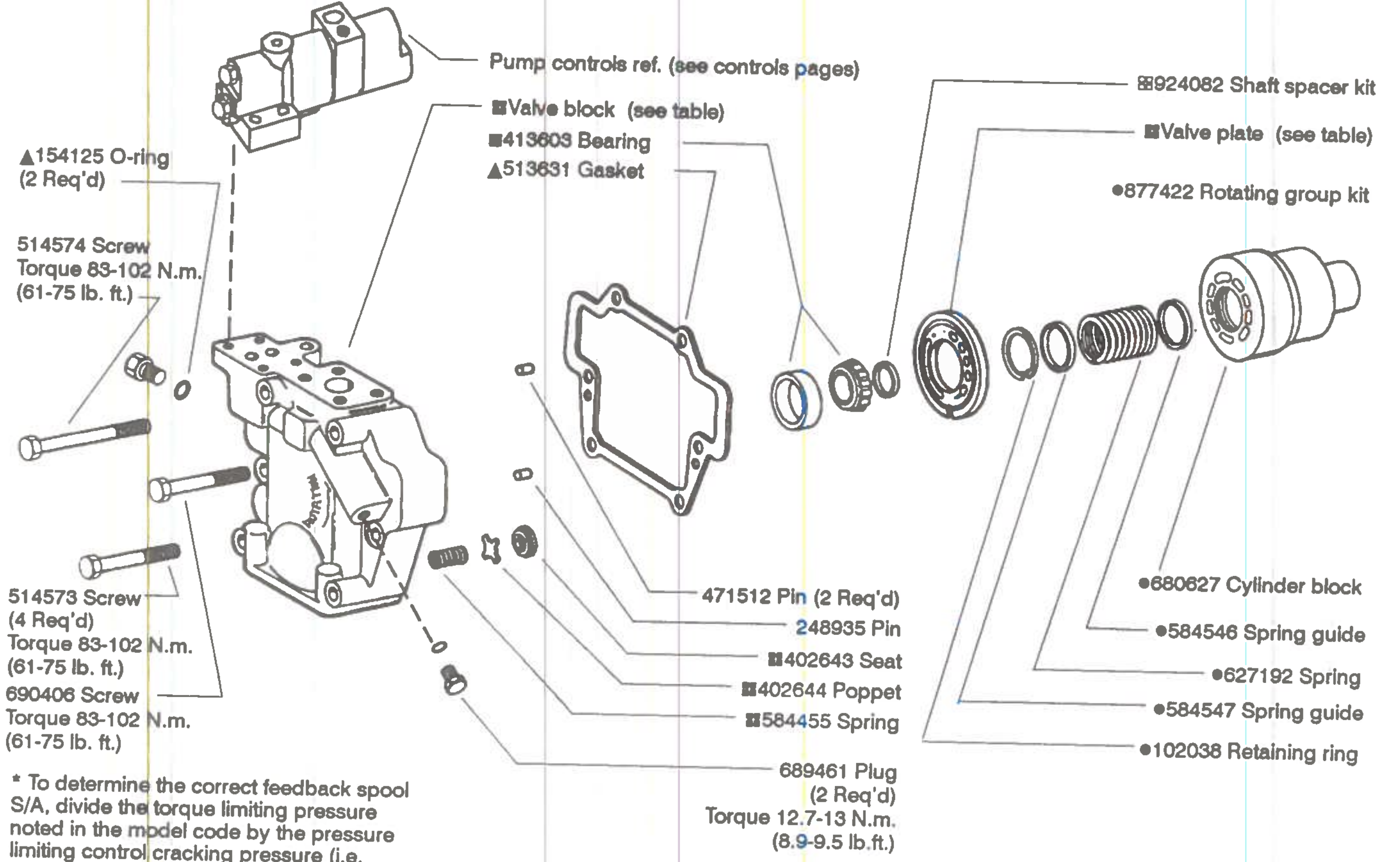
Torque Limiter - CT



Feedback Spool S/A

Part Number	T/C Ratio*
883389	0.3-0.4
883390	0.4-0.5
883391	0.5-0.6
883392	0.6-.0.7
883393	0.7-0.8

Load Sensing - C/CM/CMV



* To determine the correct feedback spool S/A, divide the torque limiting pressure noted in the model code by the pressure limiting control cracking pressure (i.e. T/C=Ratio). On a dual level pressure limiting control, use the high level pressure in this calculation.

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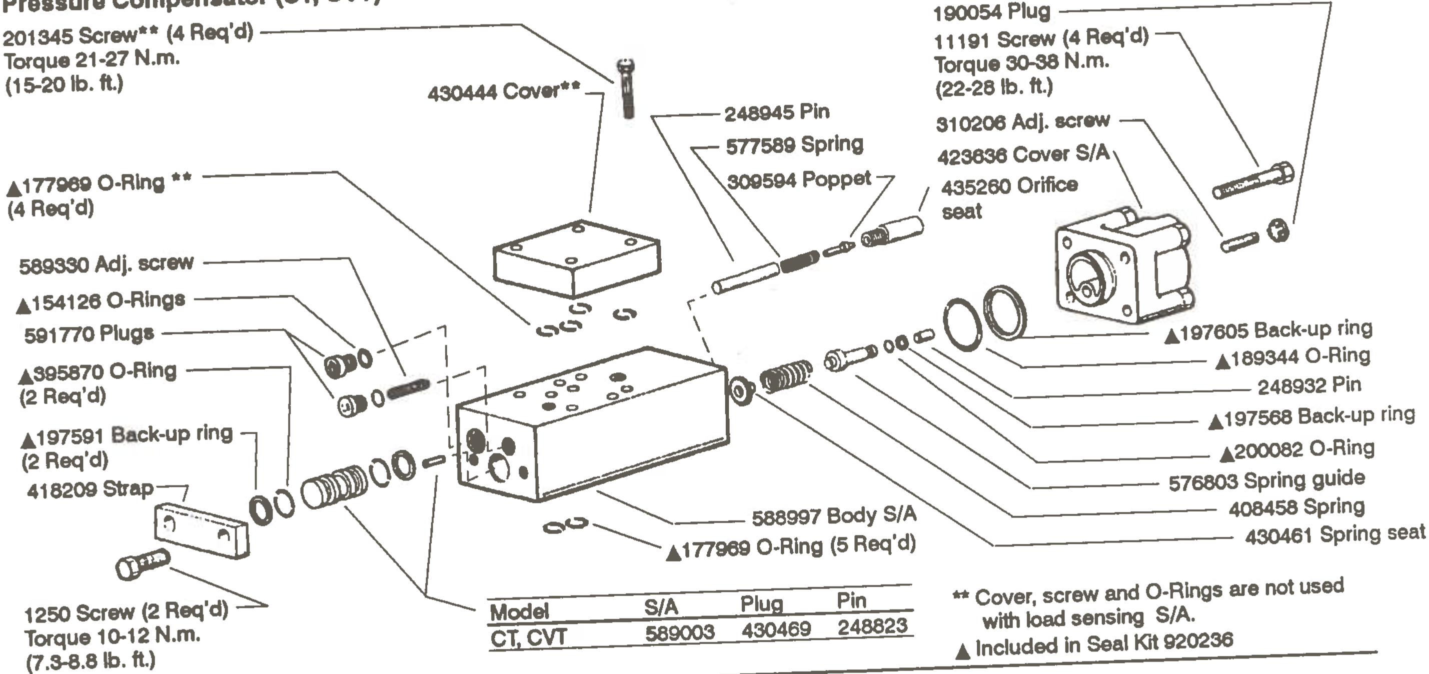
Pressure Compensator (CT, CVT)

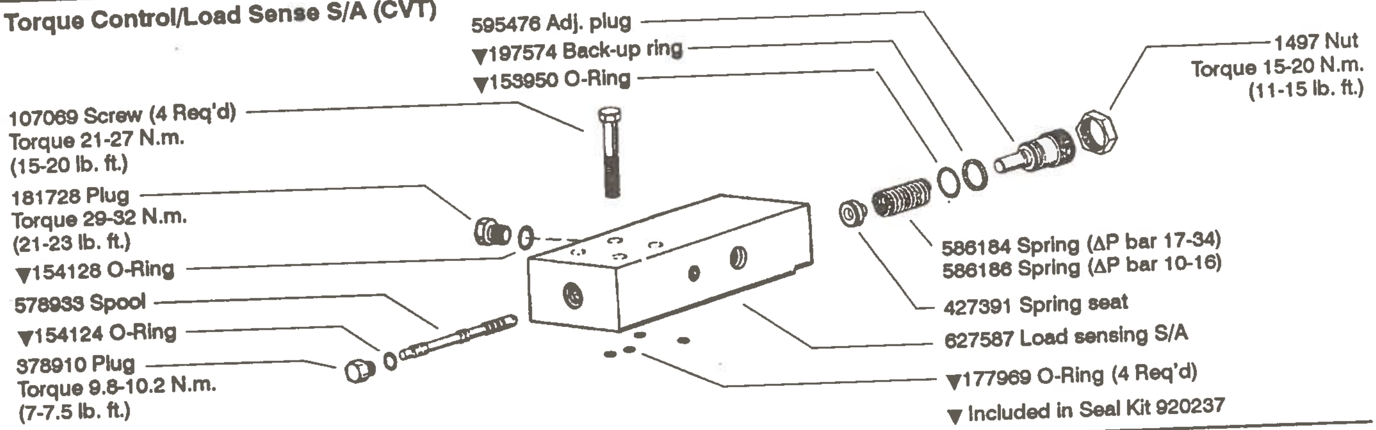


Model	S/A	Plug	Pin
CT, CVT	589003	430469	248823

** Cover, screw and O-Rings are not used with load sensing S/A.

▲ Included in Seal Kit 920236

Torque Control/Load Sense S/A (CVT)

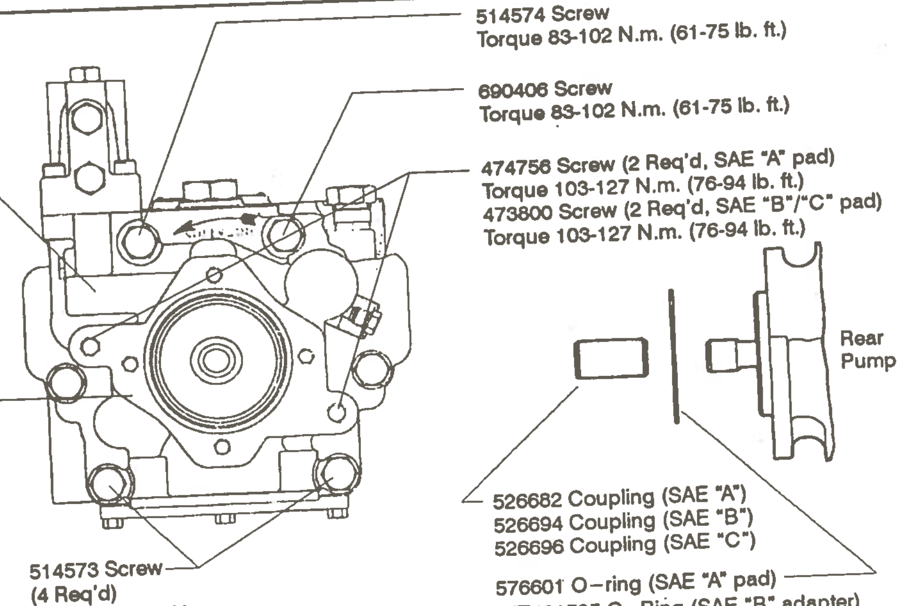


▼ Included in Seal Kit 920237

Thru-drive

Model designation	Valve block
98*–LAF–10–C	526692
98*–LAM–10–C	864266
98*–RAF–10–C	864242
98*–RAM–10–C	864243
98*–LAF–10–CT	526693
98*–LAM–10–CT	860526
98*–RAF–10–CT	883350
98*–RAM–10–CT	860528

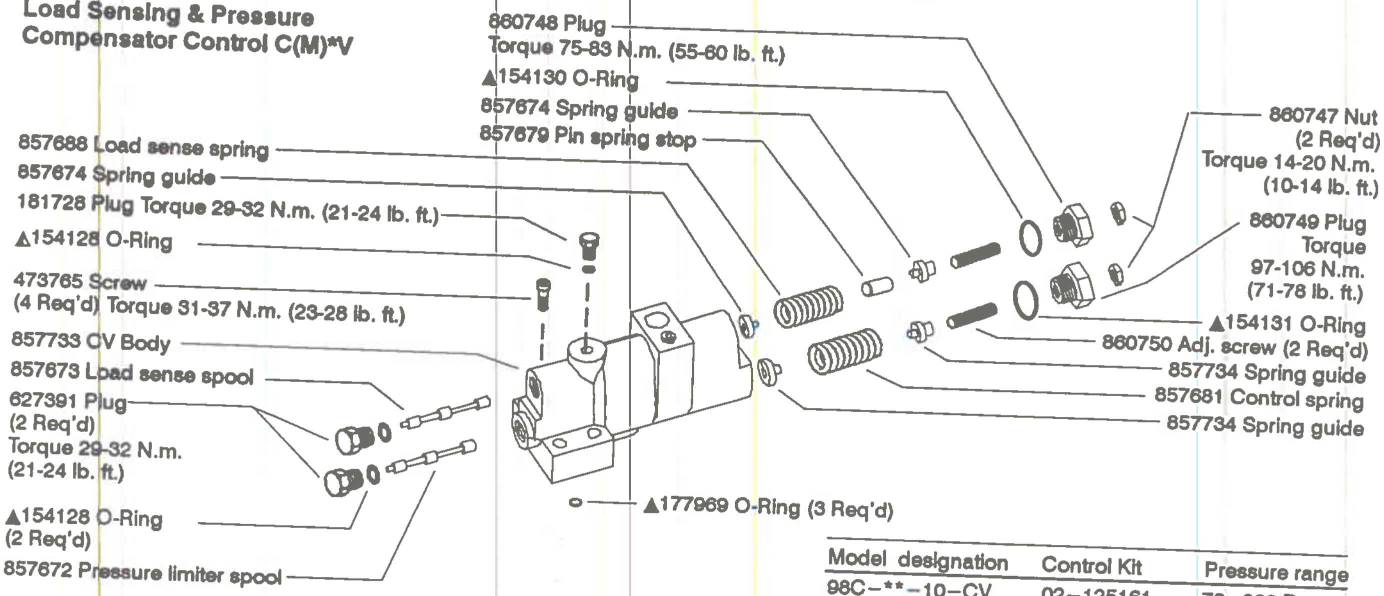
Model designation	☐Adapter (SAE "B" & "C" pad)
98*–*BF–10–C	526670
98*–*BM–10–C	876393
98C–*CF–10–C	692934
98C–*CM–10–C	876391
031 Suffix A cover	939790


514574 Screw
Torque 83-102 N.m. (61-75 lb. ft.)
690406 Screw
Torque 83-102 N.m. (61-75 lb. ft.)
474756 Screw (2 Req'd, SAE "A" pad)
Torque 103-127 N.m. (76-94 lb. ft.)
473800 Screw (2 Req'd, SAE "B"/"C" pad)
Torque 103-127 N.m. (76-94 lb. ft.)
Rear Pump
526682 Coupling (SAE "A")
526694 Coupling (SAE "B")
526696 Coupling (SAE "C")
576601 O–ring (SAE "A" pad)
▶☐401525 O–Ring (SAE "B" adapter)
☐353264 O–Ring (SAE "C" adapter)
514573 Screw
(4 Req'd)
Torque 83-102 N.m.
(61-75 lb. ft.)

☐ Available in adapter pad kit
876390 SAE B (inch)
876394 SAE B (metric)
876389 SAE C (inch)
876392 SAE C (metric)

▶Available in single shaft seal kit 02–102263
Equivalent double shaft seal kit 02–102264

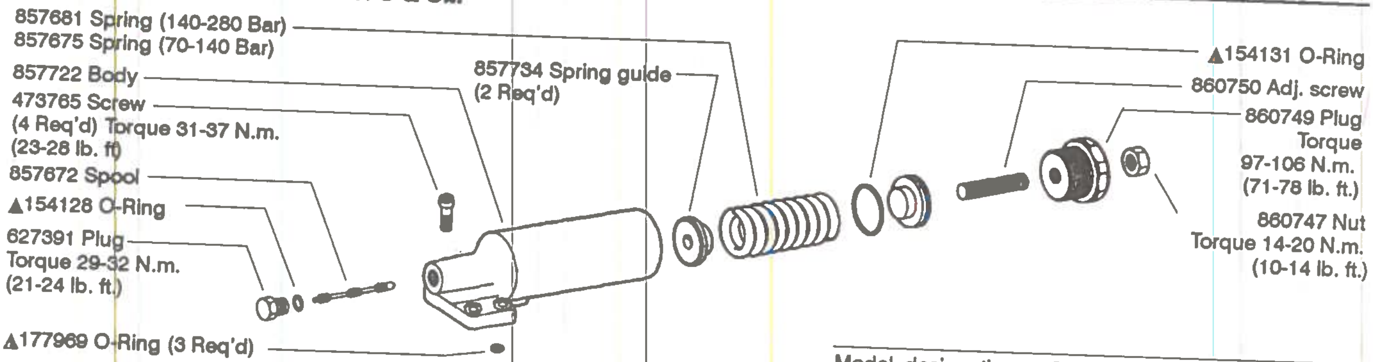
Load Sensing & Pressure Compensator Control C(M)*V



Model designation	Control Kit	Pressure range
98C-**-10-CV	02-125161	70-280 Bar
98C-**-10-CMV	02-306056	40-130 Bar

(All parts shown are included in control kit)

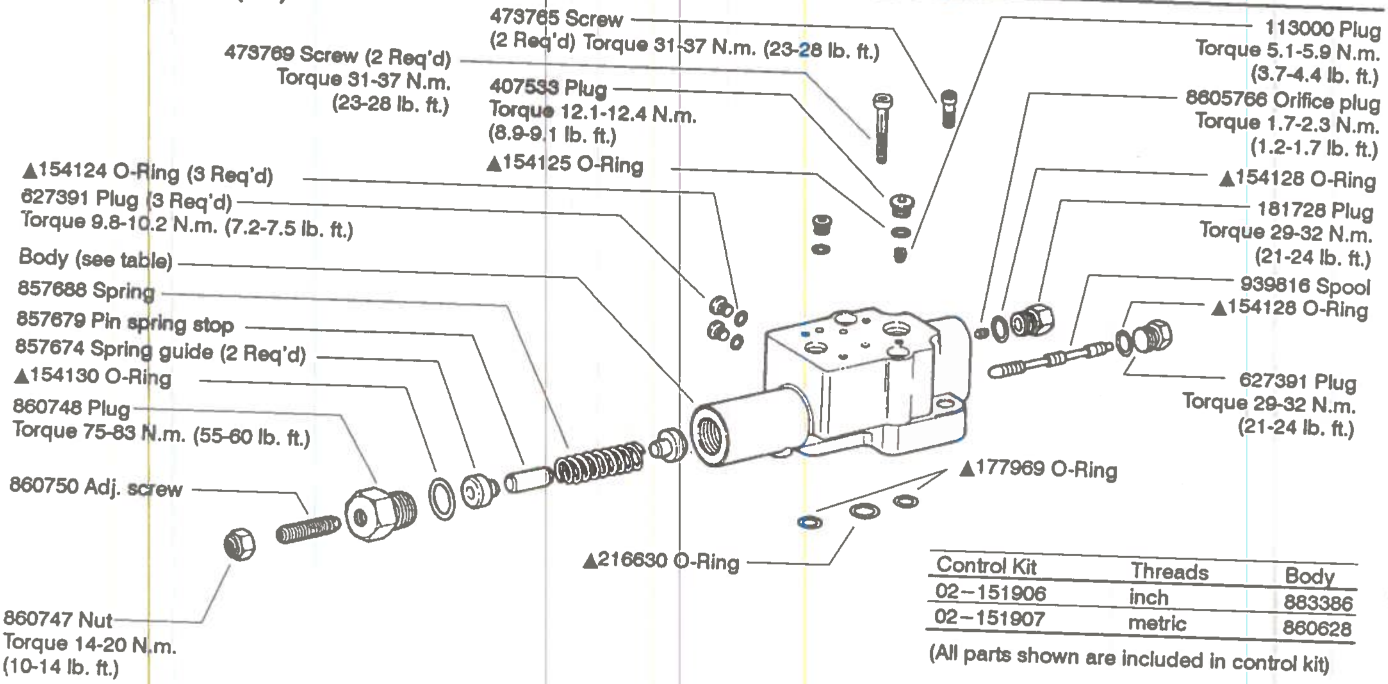
Pressure Compensator Control C & CM



Model designation	Control Kit	Pressure range
98C-**-10-C	02-125160	70-250 Bar
98C-**-10-CM	02-125162	40-130 Bar

(All parts shown are included in control kit)

Industrial Control (I.C.)

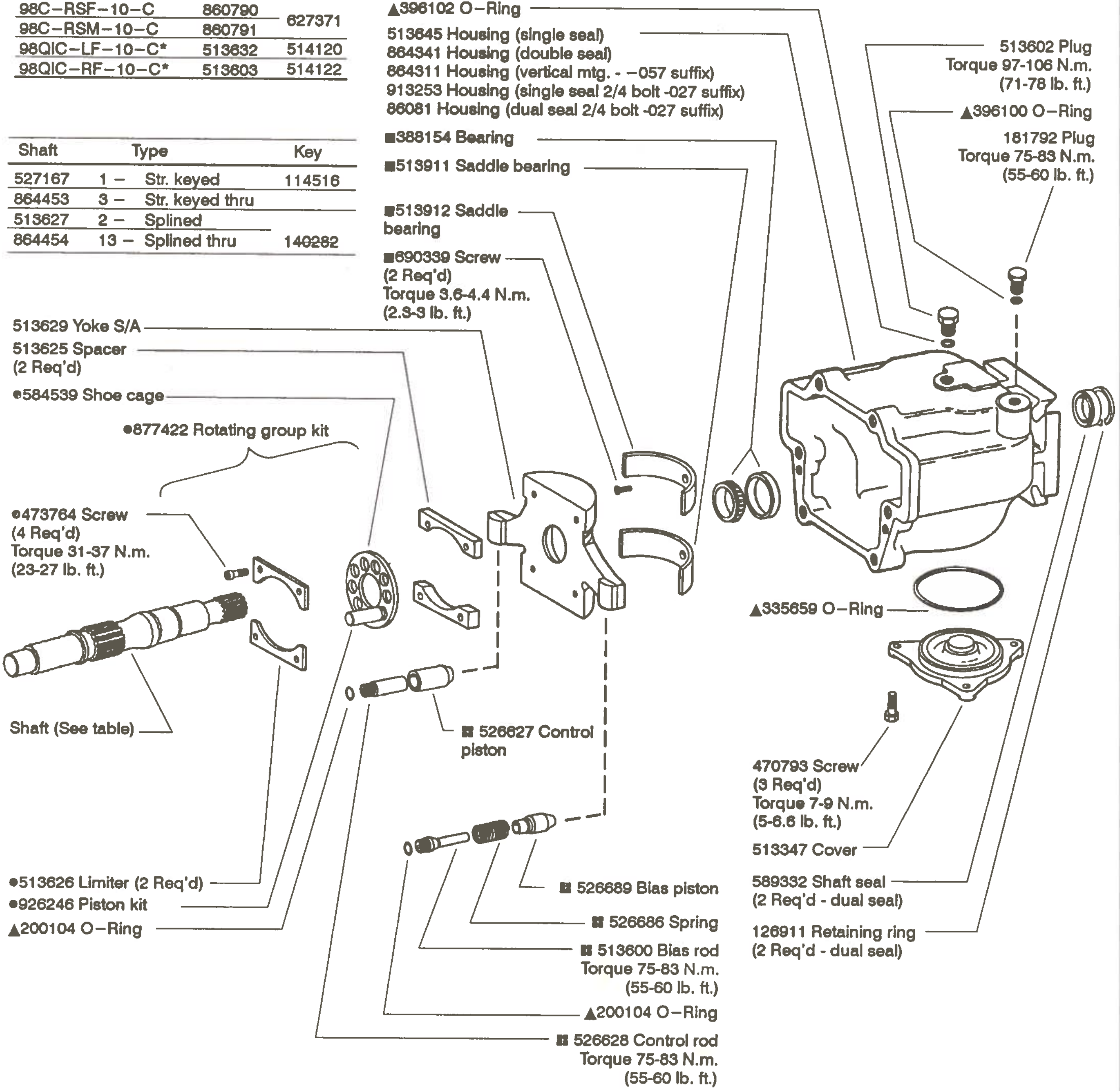


Control Kit	Threads	Body
02-151906	inch	883386
02-151907	metric	860628

(All parts shown are included in control kit)

Model designation	Valve Block	Valve Plate
98C–LF–10–C*	513632	584540
98C–LM–10–C*	864279	
98C–RF–10–C*	513603	627371
98C–RM–10–C*	864258	
98C–LF–10–CT	513635	584540
98C–LM–10–CT	860523	
98C–RF–10–CT	860524	627371
98C–RM–10–CT	860525	
98C–LSF–10–C	860798	584540
98C–LSM–10–C	860799	
98C–RSF–10–C	860790	627371
98C–RSM–10–C	860791	
98QIC–LF–10–C*	513632	514120
98QIC–RF–10–C*	513603	514122

Shaft	Type	Key
527167	1 – Str. keyed	114516
864453	3 – Str. keyed thru	
513627	2 – Splined	140282
864454	13 – Splined thru	


▲396102 O–Ring
513645 Housing (single seal)
864341 Housing (double seal)
864311 Housing (vertical mtg. - –057 suffix)
913253 Housing (single seal 2/4 bolt -027 suffix)
86081 Housing (dual seal 2/4 bolt -027 suffix)
■388154 Bearing
■513911 Saddle bearing
■513912 Saddle bearing
■690339 Screw (2 Req'd) Torque 3.6-4.4 N.m. (2.3-3 lb. ft.)
513602 Plug Torque 97-106 N.m. (71-78 lb. ft.)
▲396100 O–Ring
181792 Plug Torque 75-83 N.m. (55-60 lb. ft.)
513629 Yoke S/A
513625 Spacer (2 Req'd)
●584539 Shoe cage
●877422 Rotating group kit
●473764 Screw (4 Req'd) Torque 31-37 N.m. (23-27 lb. ft.)
Shaft (See table)
▲335659 O–Ring
◘ 526627 Control piston
470793 Screw (3 Req'd) Torque 7-9 N.m. (5-6.6 lb. ft.)
513347 Cover
●513626 Limiter (2 Req'd)
●926246 Piston kit
▲200104 O–Ring
◘ 526689 Bias piston
◘ 526686 Spring
◘ 513600 Bias rod Torque 75-83 N.m. (55-60 lb. ft.)
▲200104 O–Ring
◘ 526628 Control rod Torque 75-83 N.m. (55-60 lb. ft.)
589332 Shaft seal (2 Req'd - dual seal)
126911 Retaining ring (2 Req'd - dual seal)

NOTE

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 14/12 or cleaner.

▲ Available in single shaft seal kit 02–102263 Equivalent double shaft seal kit 02–102264

● Available in rotating group kit 877422

■ Available in bearing kit 877425

◘ NOTE

Right hand rotation shown. View is opposite for left hand rotation. Please refer to Overhaul Manual M-2210-S.

⊞ NOTE

Use shims as required to obtain 0.01–0.10 mm (.0004–.004 in.) axial shaft endplay.

Model Codes

Industrial pumps

PVH 98 QI * – * (*) * – ** * – 10 – C(M) ** (**) (**) – ** – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Mobile pumps

PVH 98 C – * (*) * – ** * – 10 – C ** (**) (**) – ** – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 Piston pump, variable displacement

2 Maximum geometric displacement

98 = 98.3 cm^3/r (6.0 in^3/r)

3 Mounting flange, prime mover end

C = SAE "C" 4-bolt type (SAE J744-127-4)

M = ISO 3019/2-125B4HW (Option for PVH57 and PVH74 only)

4 Shaft rotation, viewed at prime mover end

R = Right hand, clockwise (Standard on QI models)

L = Left hand, counterclockwise (Optional on QI models)

5 Configuration

Blank = Non-thru-drive (single pump)

A = Thru-drive pump with SAE "A" 2-bolt rear flange mounting (SAE J744-82-2)

B = Thru- drive pump with SAE "B" 2- and 4-bolt rear flange mountings† (SAE J744-101-2/4)

C = Thru-drive pump with SAE "C" 2- and 4-bolt rear flange mountings† (SAE J744-127-2/4)

S = Adjustable maximum volume stop (non-thru-drive and non-torque-control pumps only)

6 Main ports

F = SAE 4-bolt flange pads (standard)

M = SAE 4-bolt pads with metric mounting bolt threads (PVH57 & PVH74 only)

7 Shaft-end type, at prime mover end

1 =	SAE "C" (J744-32-1)	Straight keyed
2 =	SAE "C"† (J744-32-4)	Splined 14 tooth 12/24 D.P.
3 =	SAE "CC" (J744-38-4)	Splined 17 tooth 12/24 D.P.
13 =	SAE "C (J744-38-1)	Straight keyed

8 Shaft seal, prime mover end

S = Single, one-way (standard)

D = Double, two-way (optional) Recommended on second pump of tandem assembly (PVH**/PVH**) and on "wet mount" applications.

9 Pump design number

10 (Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.)

10 Pressure compensator adjustment range

C = 70-250 bar (1015-3625 psi) (standard)

CM = 40-130 bar ((580-1885 psi) (optional QI version)

IC = Industrial control, 20 bar (290 psi) differential pressure setting

11 Pressure compensator factory setting in tens of bar

25 = Normal factory setting of 250 bar for "C" models.

7 = Normal factory setting of 70 bar for "CM" models.

12 Additional control functions

Blank = No additional controls

V = Load sensing, 20 bar (290 psi) differential pressure setting

T = Torque limiter

VT = Load sensing and torque limiter

13 Torque limiter factory setting

** = Customer desired torque limiter setting specified in ten bar (145 psi) increments, e.g.:
8 = 80 bar (1160 psi);
18 = 180 bar (2610 psi).
The torque setting range is from 30–80% of the specified compensator setting.

14 Control design number

31 = C, CM, or C**V controls.

13 = C**T controls

14 = C**VT controls

10 = IC control

15 Special features suffix

027= Composite 2-bolt/4-bolt mounting conforming to SAE "C"

031= Thru-drive SAE "A" pad cover

041= No case-to-inlet relief (for use with supercharged circuits, 50 psi)

057= Shaft-up operation (vertical mount)

---

† Built from pump with SAE "A" rear pad to which suitable flange adapter is bolted. For best availability and flexibility, order PVH SAE "A" thru-drive pump and SAE "B" or "C" adapter kit separately.

† Torque restrictions apply to #2 shaft in PVH98 thru-drive pumps. Please contact a Vickers representative for review of your application.

12/93 – HH

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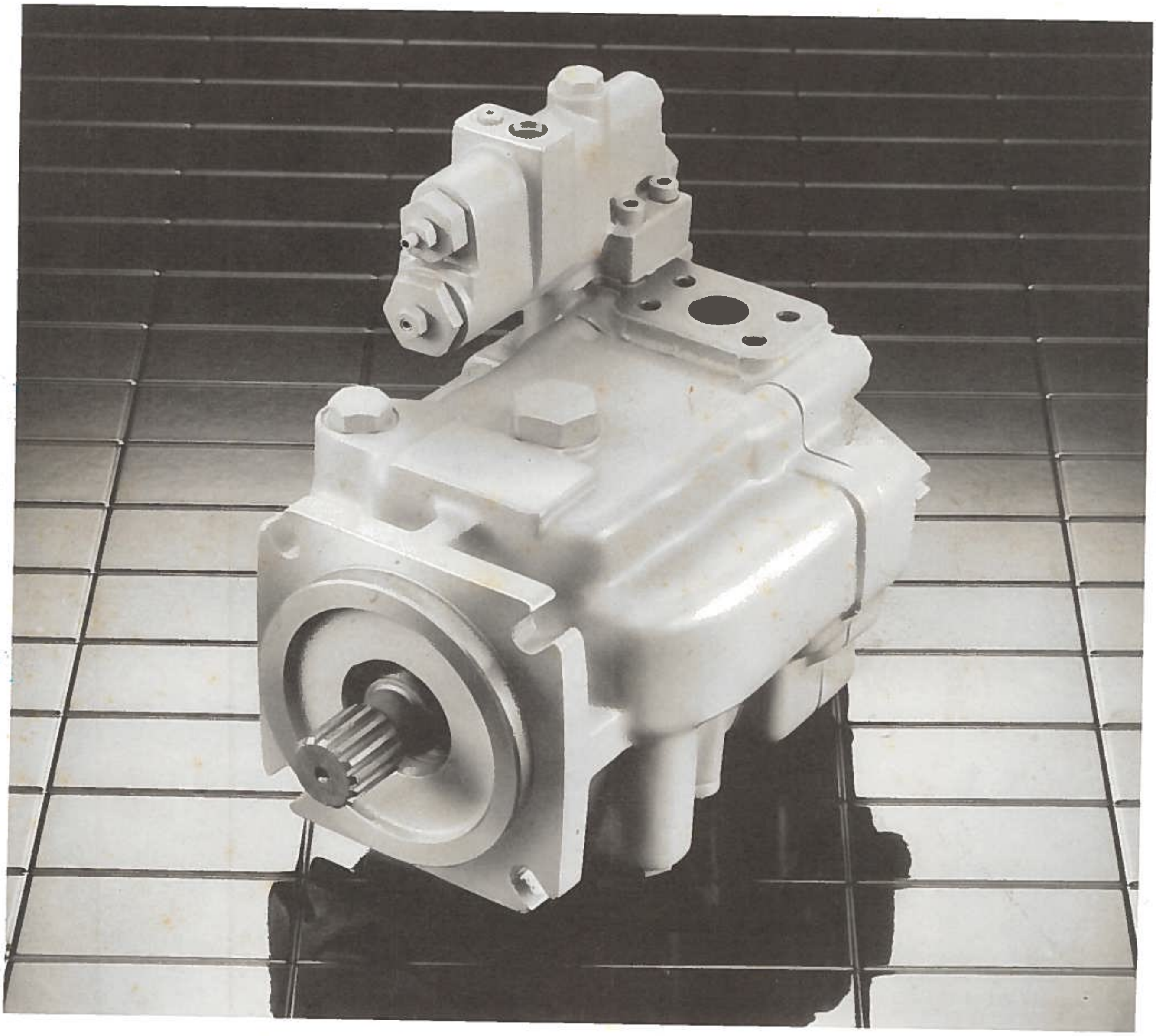
Service Data

VICKERS

PVH98 Variable Displacement Piston Pump



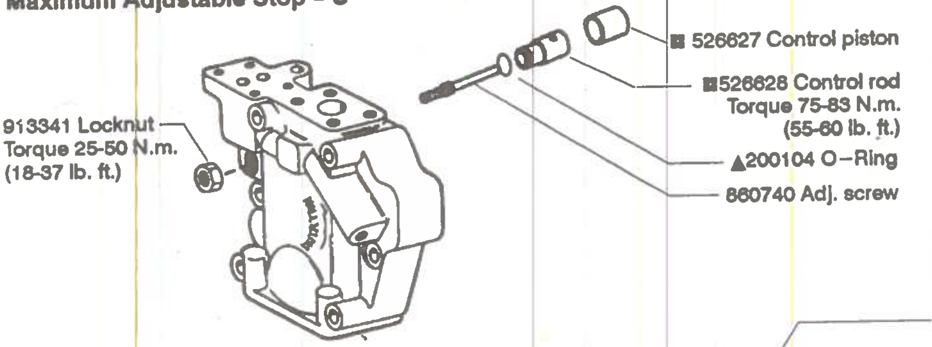
Vickers, Incorporated
A TRINOVA Company
5445 Corporate Drive
P.O. Box 302
Troy, Michigan 48007-0302

SONNY ENTERPRISES (PAK)
25
YEARS

Revised 12/93

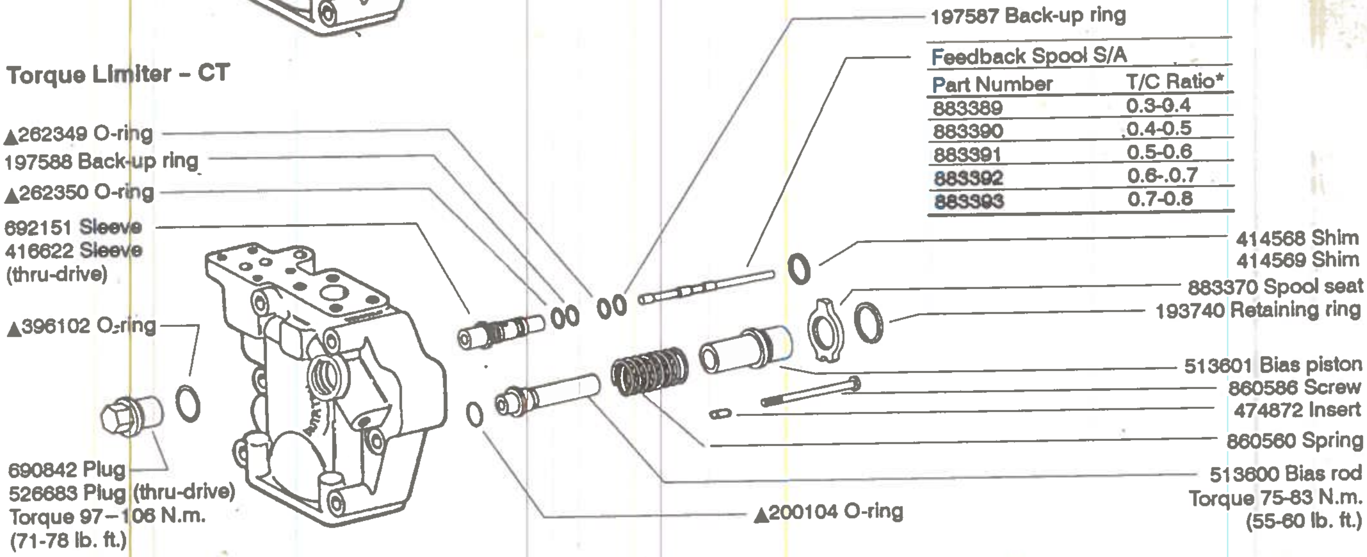
M-2208-S

Maximum Adjustable Stop – S



SONNY ENTERPRISES (PAK)
25 YEARS
★

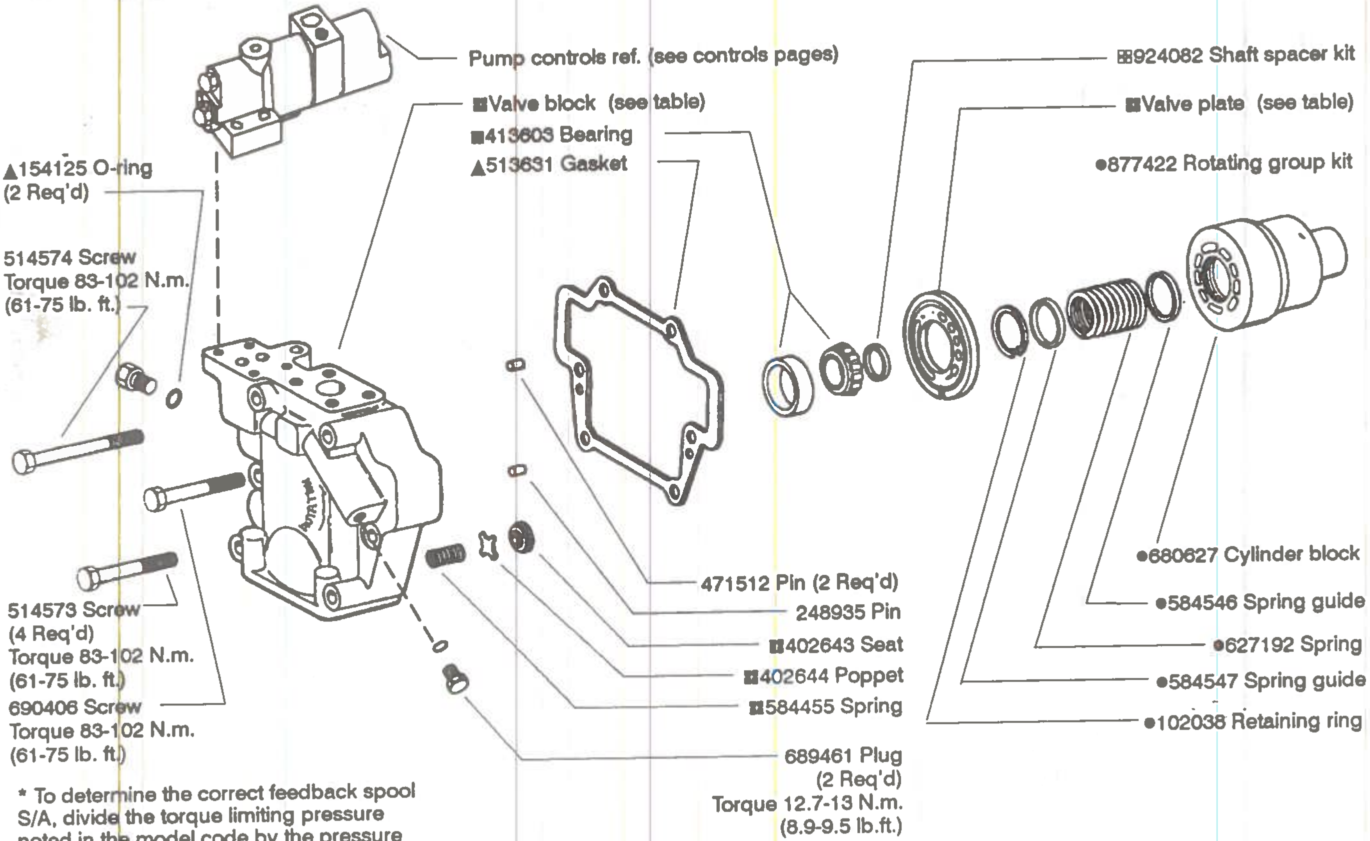
Torque Limiter – CT



Feedback Spool S/A

Part Number	T/C Ratio*
883389	0.3-0.4
883390	0.4-0.5
883391	0.5-0.6
883392	0.6-.0.7
883393	0.7-0.8

Load Sensing – C/CM/CMV



* To determine the correct feedback spool S/A, divide the torque limiting pressure noted in the model code by the pressure limiting control cracking pressure (i.e. T/C=Ratio). On a dual level pressure limiting control, use the high level pressure in this calculation.

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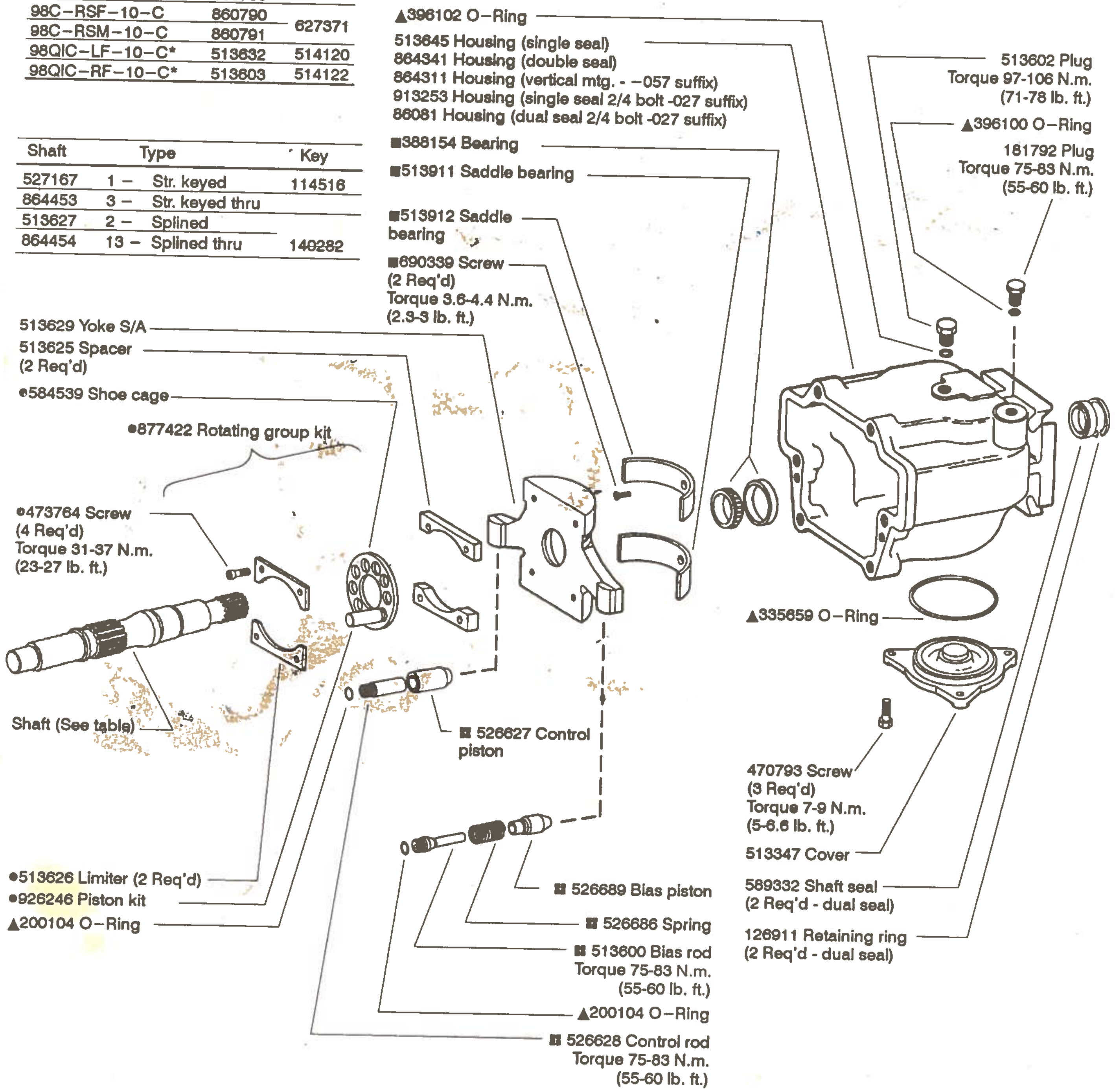
Model designation	Valve Block	Valve Plate
98C–LF–10–C*	513632	584540
98C–LM–10–C*	864279	
98C–RF–10–C*	513603	627371
98C–RM–10–C*	864258	
98C–LF–10–CT	513635	584540
98C–LM–10–CT	860523	
98C–RF–10–CT	860524	627371
98C–RM–10–CT	860525	
98C–LSF–10–C	860798	584540
98C–LSM–10–C	860799	
98C–RSF–10–C	860790	627371
98C–RSM–10–C	860791	
98QIC–LF–10–C*	513632	514120
98QIC–RF–10–C*	513603	514122

Shaft	Type	Key
527167	1 – Str. keyed	114516
864453	3 – Str. keyed thru	
513627	2 – Splined	140282
864454	13 – Splined thru	

SONNY ENTERPRISES (F.K)
25
YEARS


▲396102 O–Ring
513645 Housing (single seal)
864341 Housing (double seal)
864311 Housing (vertical mtg. - –057 suffix)
913253 Housing (single seal 2/4 bolt -027 suffix)
86081 Housing (dual seal 2/4 bolt -027 suffix)
■388154 Bearing
■513911 Saddle bearing
■513912 Saddle bearing
■690339 Screw (2 Req'd) Torque 3.6-4.4 N.m. (2.3-3 lb. ft.)
513602 Plug Torque 97-106 N.m. (71-78 lb. ft.)
▲396100 O–Ring
181792 Plug Torque 75-83 N.m. (55-60 lb. ft.)
513629 Yoke S/A
513625 Spacer (2 Req'd)
●584539 Shoe cage
●877422 Rotating group kit
●473764 Screw (4 Req'd) Torque 31-37 N.m. (23-27 lb. ft.)
Shaft (See table)
▣ 526627 Control piston
▲335659 O–Ring
470793 Screw (3 Req'd) Torque 7-9 N.m. (5-6.6 lb. ft.)
513347 Cover
589332 Shaft seal (2 Req'd - dual seal)
126911 Retaining ring (2 Req'd - dual seal)
●513626 Limiter (2 Req'd)
●926246 Piston kit
▲200104 O–Ring
▣ 526689 Bias piston
▣ 526686 Spring
▣ 513600 Bias rod Torque 75-83 N.m. (55-60 lb. ft.)
▲200104 O–Ring
▣ 526628 Control rod Torque 75-83 N.m. (55-60 lb. ft.)

▣ NOTE
Right hand rotation shown. View is opposite for left hand rotation. Please refer to Overhaul Manual M-2210-S.

⊞ NOTE
Use shims as required to obtain 0.01–0.10 mm (.0004–.004 in.) axial shaft endplay.

NOTE
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 14/12 or cleaner.

▲ Available in single shaft seal kit 02–102263
Equivalent double shaft seal kit 02–102264
● Available in rotating group kit 877422
■ Available in bearing kit 877425

Model Codes

Industrial pumps

PVH 98 QI * – * (*) * – ** * – 10 – C(M) ** (**) (**) – ** – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Mobile pumps

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1 Piston pump, variable displacement

2 Maximum geometric displacement

98 = 98.3 cm³/r (6.0 in³/r)

3 Mounting flange, prime mover end

C = SAE "C" 4-bolt type (SAE J744-127-4)
M = ISO 3019/2–125B4HW (Option for PVH57 and PVH74 only)

4 Shaft rotation, viewed at prime mover end

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8 Shaft seal, prime mover end

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9 Pump design number

10 (Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.)

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C = 70-250 bar (1015-3625 psi) (standard)
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18 = 180 bar (2610 psi).
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14 = C**VT controls
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031= Thru-drive SAE "A" pad cover
041= No case-to-inlet relief (for use with supercharged circuits, 50 psi)
057= Shaft-up operation (vertical mount)

SUNNY ENTERPRISES (PAK)
25 YEARS
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† Built from pump with SAE "A" rear pad to which suitable flange adapter is bolted. For best availability and flexibility, order PVH SAE "A" thru-drive pump and SAE "B" or "C" adapter kit separately.

† Torque restrictions apply to #2 shaft in PVH98 thru-drive pumps. Please contact a Vickers representative for review of your application.

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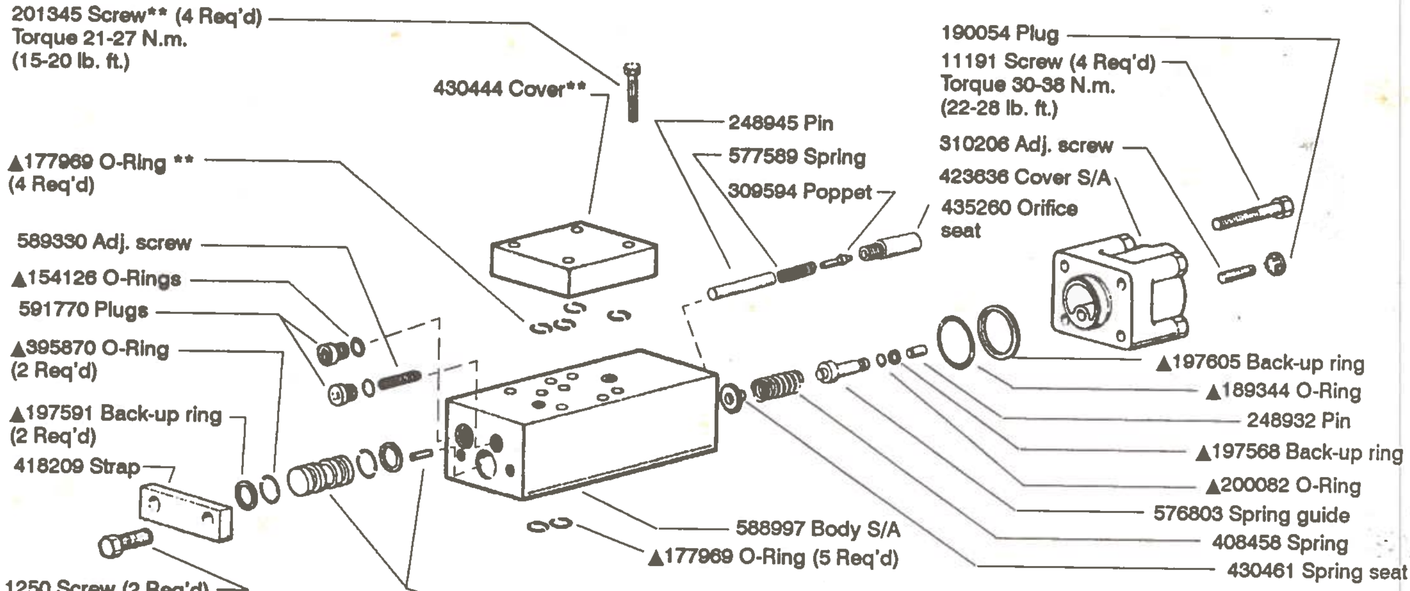
Pressure Compensator (CT, CVT)

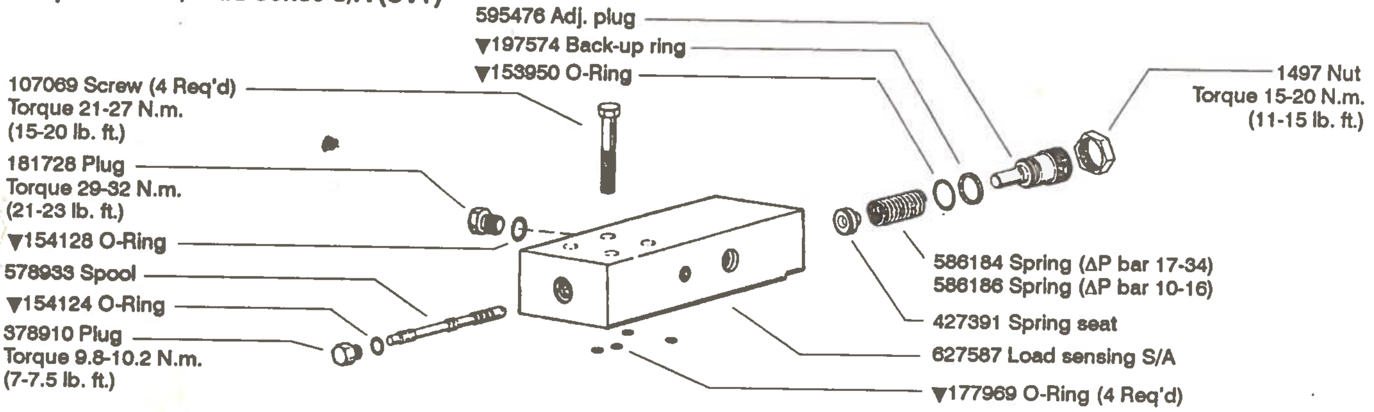


Model	S/A	Plug	Pin
CT, CVT	589003	430469	248823

** Cover, screw and O-Rings are not used with load sensing S/A.

▲ Included in Seal Kit 920236

Torque Control/Load Sense S/A (CVT)

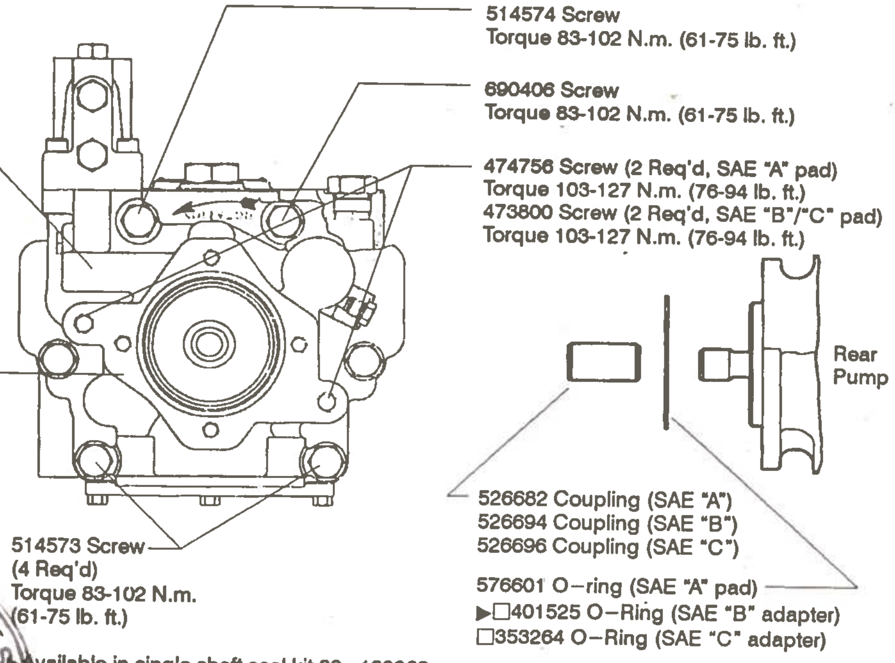


▼ Included in Seal Kit 920237

Thru-drive

Model designation	Valve block
98*-LAF-10-C	526692
98*-LAM-10-C	864266
98*-RAF-10-C	864242
98*-RAM-10-C	864243
98*-LAF-10-CT	526693
98*-LAM-10-CT	860526
98*-RAF-10-CT	883350
98*-RAM-10-CT	860528

Model designation	☐Adapter (SAE "B" & "C" pad)
98*-*BF-10-C	526670
98*-*BM-10-C	876393
98C-*CF-10-C	692934
98C-*CM-10-C	876391
031 Suffix A cover	939790

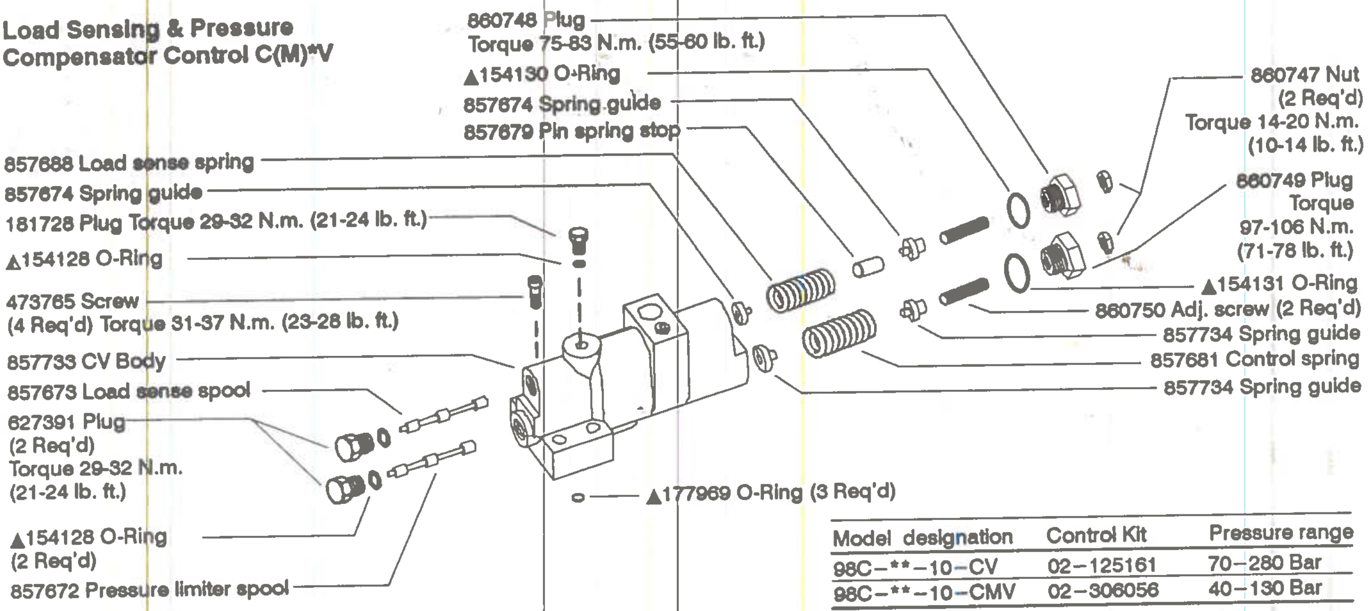

514574 Screw
Torque 83-102 N.m. (61-75 lb. ft.)
690406 Screw
Torque 83-102 N.m. (61-75 lb. ft.)
474756 Screw (2 Req'd, SAE "A" pad)
Torque 103-127 N.m. (76-94 lb. ft.)
473600 Screw (2 Req'd, SAE "B"/"C" pad)
Torque 103-127 N.m. (76-94 lb. ft.)
Rear Pump
526682 Coupling (SAE "A")
526694 Coupling (SAE "B")
526696 Coupling (SAE "C")
576601 O-ring (SAE "A" pad)
▶☐401525 O-Ring (SAE "B" adapter)
☐353264 O-Ring (SAE "C" adapter)
514573 Screw
(4 Req'd)
Torque 83-102 N.m.
(61-75 lb. ft.)

☐ Available in adapter pad kit
876390 SAE B (inch)
876394 SAE B (metric)
876389 SAE C (inch)
876392 SAE C (metric)

▶Available in single shaft seal kit 02-102263
Equivalent double shaft seal kit 02-102264

SUNNY ENTERPRISES (PAK)
25 YEARS

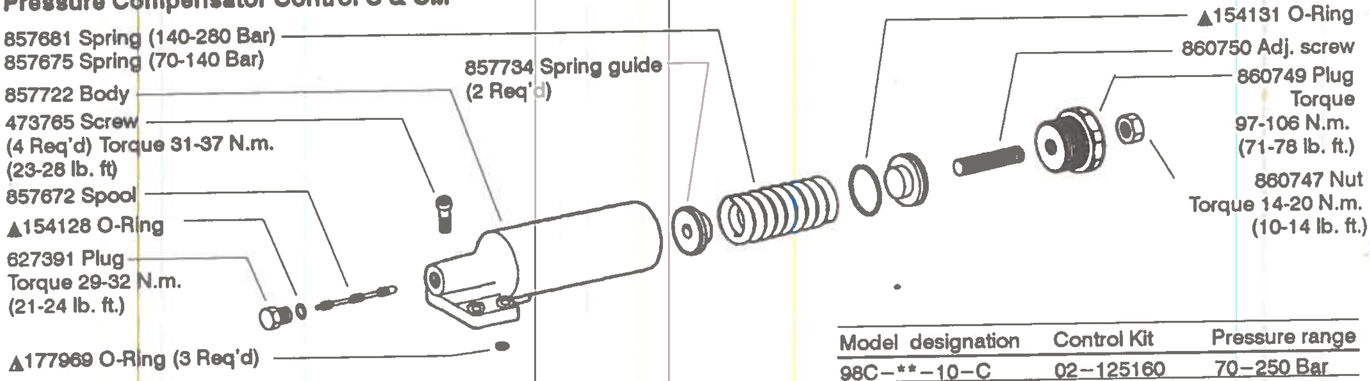
Load Sensing & Pressure Compensator Control C(M)*V



Model designation	Control Kit	Pressure range
98C-**-10-CV	02-125161	70-280 Bar
98C-**-10-CMV	02-306056	40-130 Bar

(All parts shown are included in control kit)

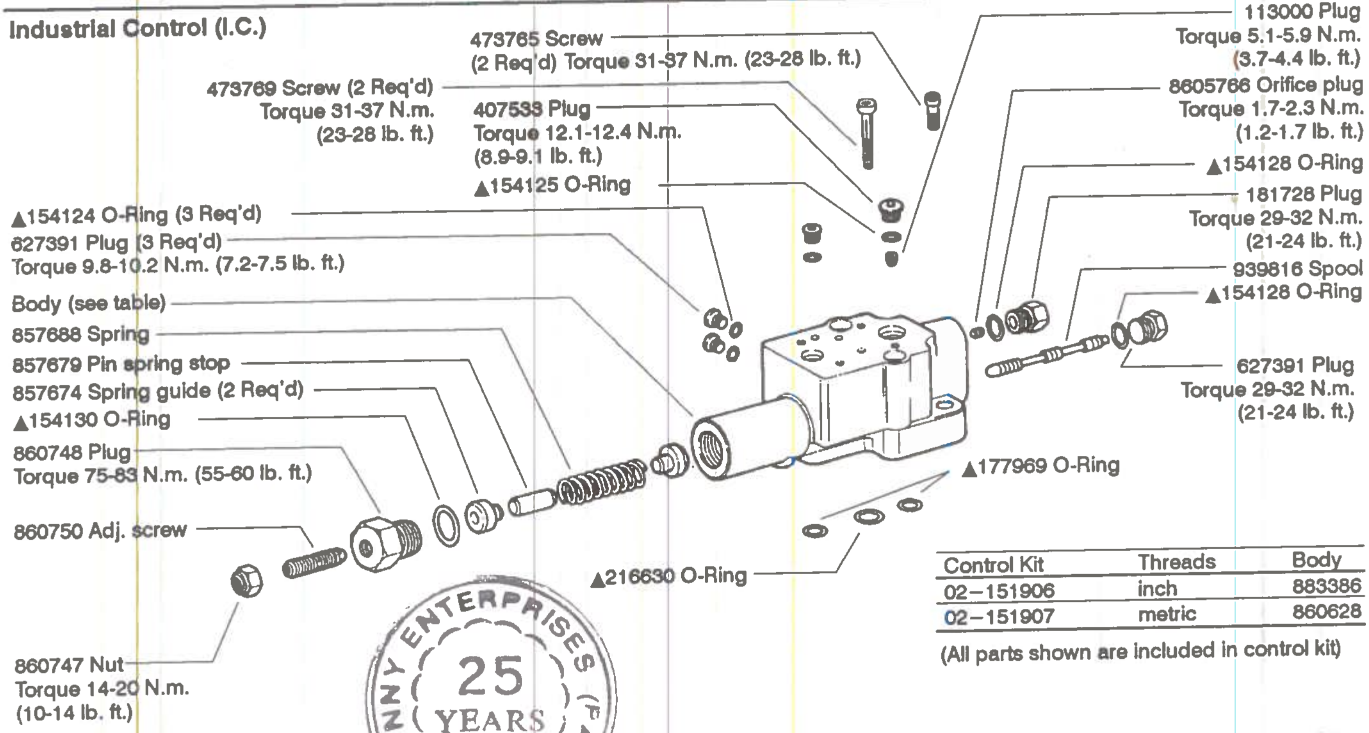
Pressure Compensator Control C & CM



Model designation	Control Kit	Pressure range
98C-**-10-C	02-125160	70-250 Bar
98C-**-10-CM	02-125162	40-130 Bar

(All parts shown are included in control kit)

Industrial Control (I.C.)



Control Kit	Threads	Body
02-151906	inch	883386
02-151907	metric	860628

(All parts shown are included in control kit)

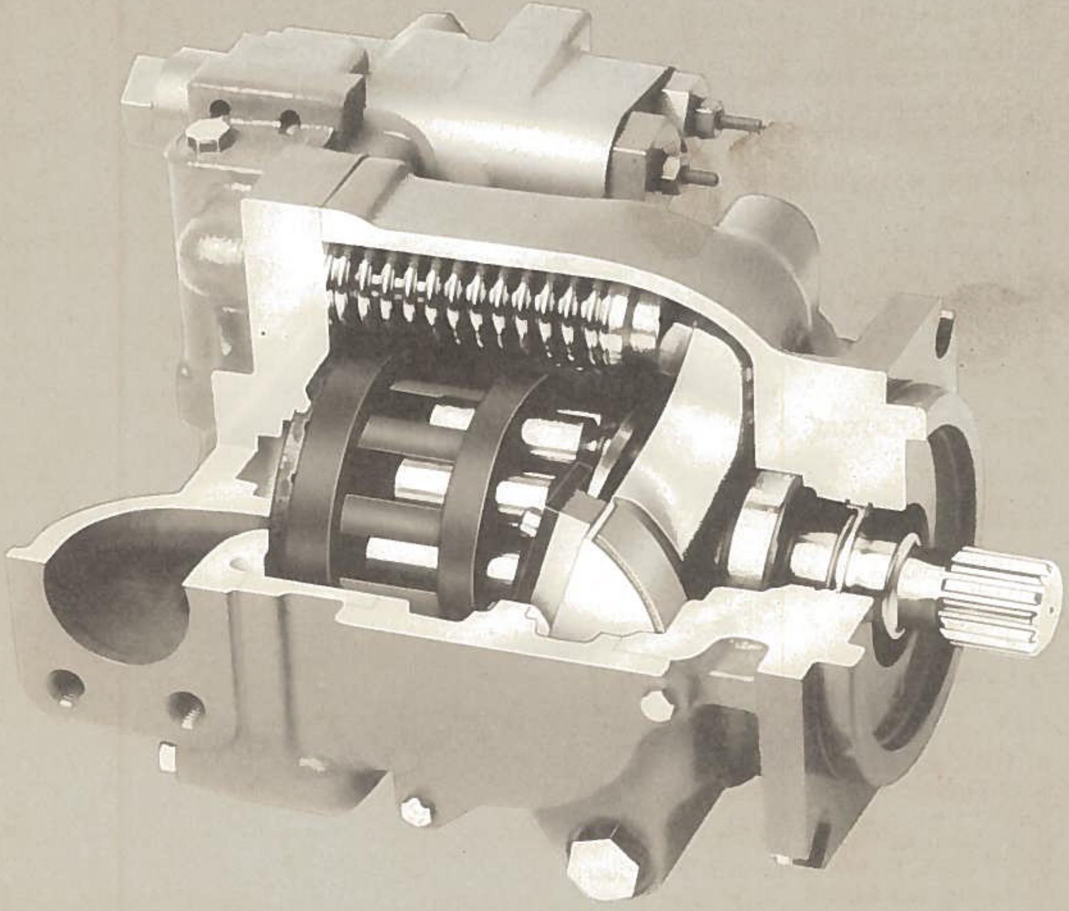
SUNNY ENTERPRISES (PAK) 25 YEARS

VICKERS

67

Overhaul Manual

PVH Piston Pump
Pressure Compensator & Load Sensing Controls



Released 11–1–90

M–2210–S

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Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes basic operating characteristics and provides service and overhaul information for PVH 57/74/98/131 series piston pumps. The information contained herein pertains to the latest design series as shown in the model code breakdown in Table 1.

B. RELATED PUBLICATIONS

Service part numbers and installation dimensions are not included in this manual. The service parts drawings that pertain to the PVH series pumps are listed in Table 2. These drawings are available from any sales engineering office.

C. MODEL CODE DESCRIPTION

Each pump is identified by a model code description number that is stamped on the pump's nameplate. The model code is divided into two parts. Service inquiries should always include the complete model code number.

MODEL CODE BREAKDOWN

PVH PISTON PUMPS

P V H * (QI) * – * – * * * – * – * – * – * – *

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 INLINE PISTON UNIT

"H" SERIES

4 FLOW RATING

57 – 57 cc/rev
74 – 74 cc/rev
98 – 98 cc/rev
131 – 131 cc/rev

5 QUIET VERSION

"QI" Quiet Industrial
Blank Mobile version

6 MOUNTING FLANGE

C – SAE "C" 4 BOLT
M – ISO/VDMA STD.

7 ROTATION

Viewed from shaft end
R – RIGHT HAND
L – LEFT HAND

8 CONFIGURATION

BLANK – NON THRU–DRIVE
A – SAE "A" PAD THRU–DRIVE
B – SAE "B" PAD THRU–DRIVE
C – SAE "C" PAD THRU–DRIVE

9 PORTS

F – SAE FLANGE PORTS (STD.)
M – METRIC FLANGE PORTS (OPT.)

10 SHAFT

1 – SAE "C" STR. KEY (PVH57/74/98)
2 – SAE "C" SPLINE (PVH57/74/98)
3 – SAE "CC" SPLINE (PVH74/98/131)
13 – SAE "CC" STR. KEY (PVH74/98/131)
16 – SAE "D" STR. KEY (PVH131)
N – ISO 3019 – 2 STR. KEY

11 SHAFT SEAL

S – SINGLE (STD.)
D – DOUBLE (OPT.)

12 PUMP DESIGN

13 CONTROL OPTIONS

C –	HIGH RANGE PRESSURE COMPENSATOR (70–250 bar)
C**V –	PRESSURE COMPENSATOR WITH LOAD SENSING

14 PRESSURE COMP. SETTING

Tens of bar (i.e. 25 = 250 bar)
BLANK – FIELD ADJUSTED

15 CONTROL DESIGN

–30 – C, CV

Table 1. Model Code Breakdown

Section II – DESCRIPTION

A. BASIC PUMP

Figure 1 shows the basic construction of the PVH series piston pump. Major parts include the drive shaft, housing, yoke, rotating group, valve plate, control piston, bias piston, valve block and compensator control. The PVH series pumps include a new yoke assembly which replaces the pintle bearing assembly with saddle bearings which enhance performance, reduces weight and eliminates roller bearing parts which added to maintenance time and overhaul costs.

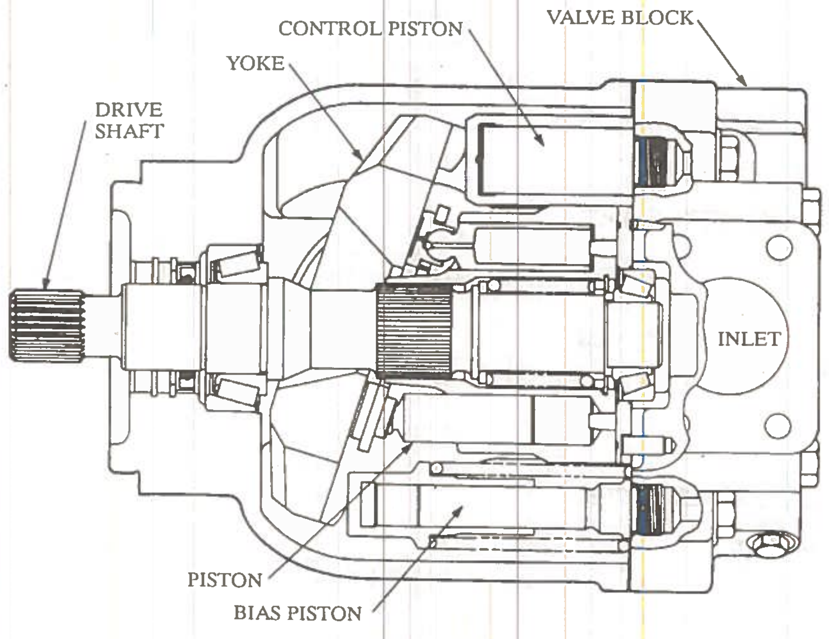
The rotating group consists of nine piston/shoe subassemblies, a cylinder block and cage.

B. PUMP CONTROLS

Two of the common types of pump controls are available. One type is the standard 'C' compensator control that limits pump outlet pressure to a desired level. The other type of control is the 'CV' pressure limiter/load sensing control. This control limits pump outlet pressure and also regulates pump displacement to match load requirements. Control types are shown in Figures 3 and 4.

Model	Service Parts Drawing
PVH57*-**-22-C**-21	M-2206-S
PVH74*-**-22-C**-21	M-2207-S
PVH98*-**-22-C**-21	M-2208-S
PVH131*-**-21-C**-21	M-2209-S

Table 2. Related Publications



PVH Section View

Figure 1. PVH Basic Description

Section III – PRINCIPLES OF OPERATION

A. BASIC PUMP OPERATION

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate. See Figure 2. The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted valve plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

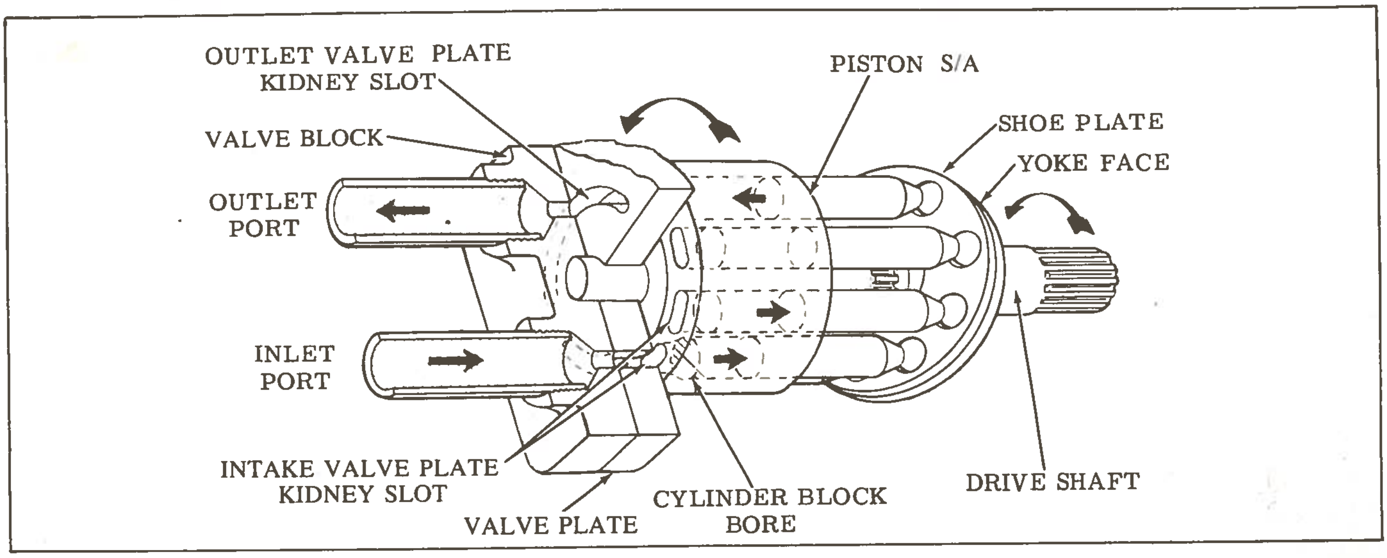


Figure 2. Basic Pump Operation

B. CONTROL OPERATION

1. 'C' Compensator Control – The standard 'C' compensator control is an internally pilot operated, spring offset, 3-way valve. Its purpose is to limit system pressure to some desired level by varying pump displacement. This control only provides the flow required to satisfy the load demand, while maintaining a constant preset pressure. Refer to Figure 3 for the following discussion.

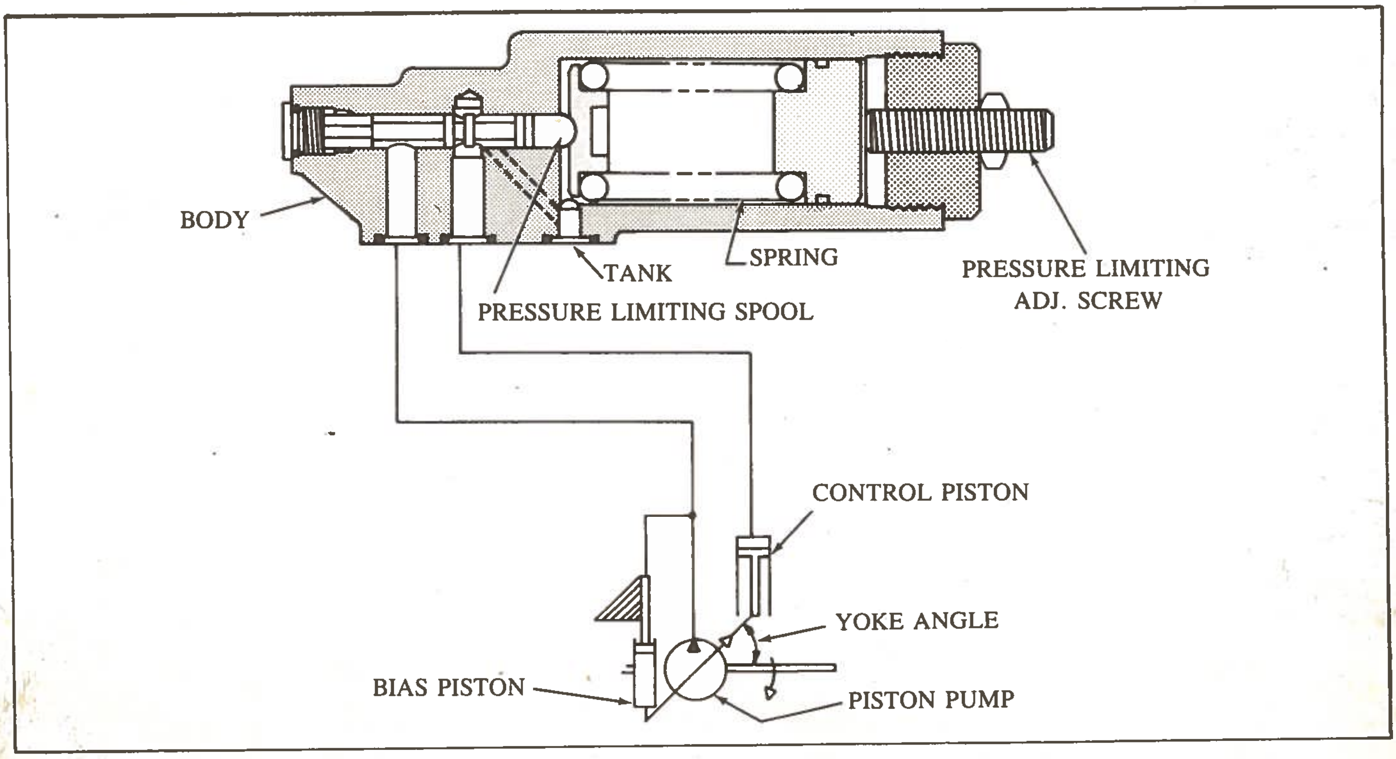


Figure 3. Pressure Compensated 'C' Control System

During operation, load or system pressure is continually fed to the bias piston. The function of the bias piston is to maintain the yoke at a full pump displacement position. Load or system pressure is also fed to the compensator spool chamber within the control. Pressure within the compensator spool chamber acts upon the spring force of the compensator spring.

When load or system pressure is below the pressure setting of the compensator spring, the compensator spool remains offset and the pump continues to operate at full displacement. When load or system pressure approaches the compensator pressure setting, the compensator spool will start to move and overcome the compensator spring force. Fluid will then meter into the control piston area. Since the control piston area is greater than that of the bias piston, the control piston pushes the yoke towards minimum pump displacement. The compensator control continues to meter fluid to the control piston, adjusting the pump displacement, and pumping only enough fluid to satisfy the load demand while holding the system at a constant pressure.

When load or system pressure exceeds the compensator setting, the compensator spool shifts towards the spring chamber area. A maximum amount of fluid is then metered to the control piston area, causing the yoke to shift to minimum pump displacement.

When system pressure decreases below the compensator pressure setting, the compensator spool returns to its original position and the yoke returns to maintain maximum pump displacement.

C. OPERATION OF THE LOAD SENSING/PRESSURE LIMITING CONTROL

THEORY OF OPERATION

1. LOAD SENSING PRESSURE LIMITING CONTROL OPERATION - As you would expect from the title, this control is a combination of the features of both the pressure limiting and load sensing controls. Refer to Figure 4 during the following explanation:

The load sensing spool senses the pressure difference (ΔP) between pump outlet and load pressure across a series flow control or system directional valve which is inherant in its operation. This differential pressure causes the load sensing spool to move against its spring to the closed-center position. If the differential pressure (ΔP) increases (greater flow through the series valve), the load sensing spool moves to the right. This opens discharge to the control piston. Outlet pressure at the control piston strokes the yoke toward a lower flow and stops when differential pressure again causes the load sensing spool to move to the closed-center position.

If differential pressure lowers (less flow through the series valve), the load sensing spool moves to the left opening the control piston to tank. The bias piston then strokes the yoke toward a higher flow. When differential pressure (ΔP) increases enough to move the load sensing spool to the closed-center position, yoke movement will stop and flow will remain constant.

The load sensing portion of the control operates as a function of the pressure drop across the series valves (ΔP), and is independent of system pressure. It establishes a constant flow characteristic from the pump based on the magnitude of the directional valve opening (operator controlled).

If outlet pressure increases to the maximum pressure limit setting, the pressure limiting spool meters fluid to the control piston. The control piston moves the yoke to reduce flow. If outlet pressure continues to rise, the spool will continue to meter fluid to the control piston and the pump will stroke to zero flow at maximum pressure.

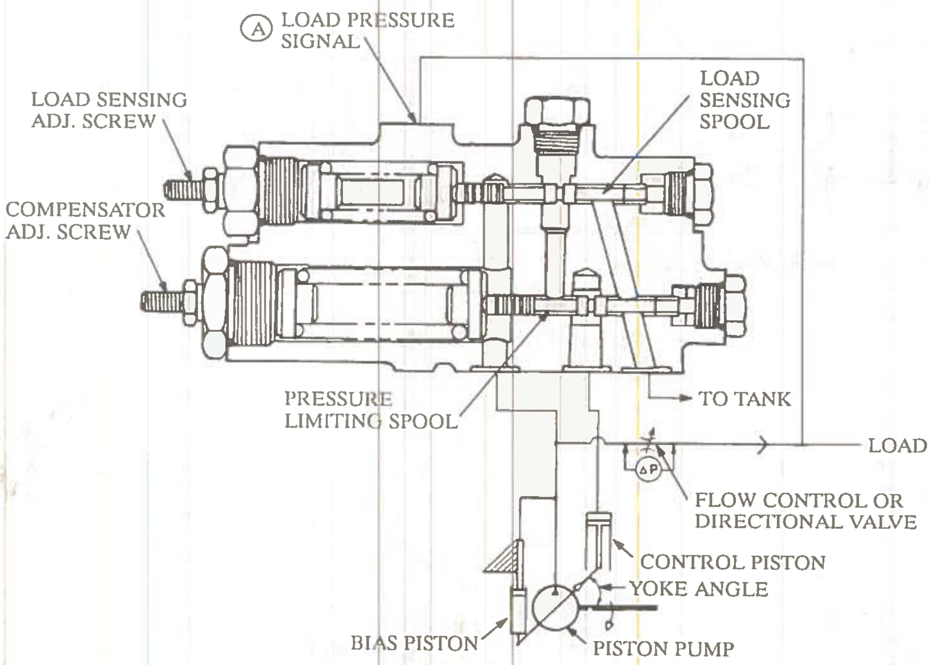


Figure 4. Load Sensing Control System

2. REDUCED HORSEPOWER STANDBY FEATURE

STANDBY DEFINED – When the system flow control valve or directional valve is closed completely, the circuit is placed in standby. See Figure 4.

NOTE

This feature assumes the system flow control valve or directional valve provides decompression of load sensing pressure in the standby, fully closed position. Pressure at point (A) (Figure 4) must decay toward zero through the system flow control or directional valve for standby to occur. Decompression of the load sensing pressure allows the pump to stroke to zero flow and minimum pressure. The circuit functions in the following manner.

Assume the flow control or directional valve is closed and there is no bleed of point (A) to tank. The fluid is trapped and the load sensing spool is held to the left by the spring. The system pressure rises until the pressure limiting spool takes over. The yoke then strokes to zero flow and holds pressure at the maximum limiter setting.

If, in the closed condition, the flow control or system directional valve bleeds point (A) to tank, the load sensing feedback pressure will decay. The load sensing spool will shift to the left. Fluid then meters through the pressure limiting spool and into the control piston. Outlet pressure decays through pump leakage following the decay of feedback pressure (A) until minimum pressure (P) is reached. The pump will operate in the standby mode (zero flow, minimum pressure) until the flow control or system directional valve demands flow from the pump. At this time, normal operation of the control will resume.

D. ADJUSTMENT PROCEDURE: LOAD SENSING PRESSURE LIMITING CONTROL

1. GENERAL

This procedure contains information on the PVH pressure limiting and load sensing control. Test and adjustment procedures are provided for standard units.

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure.

NOTE

Pressure gauges must be installed into the system before adjustment of the control can be performed. Complete field test adjustment procedures are included.

2. SET UP

a. Make sure all machine controls are in the OFF or neutral position.

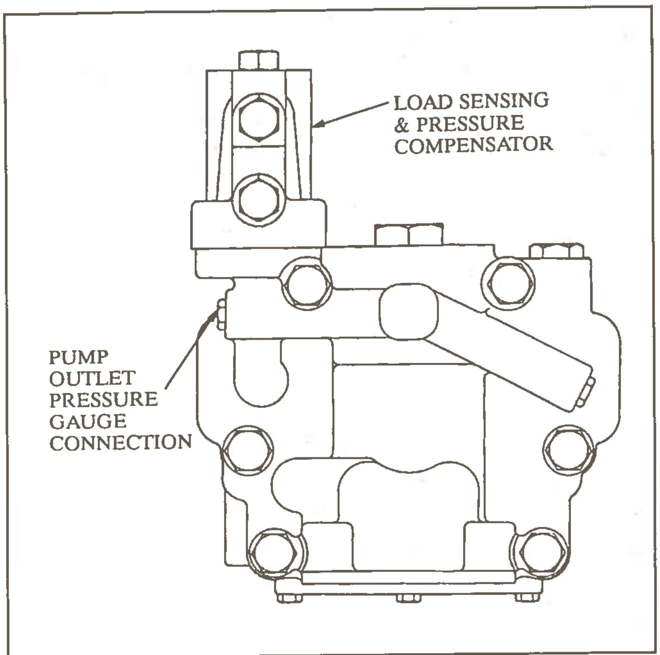

LOAD SENSING & PRESSURE COMPENSATOR
PUMP OUTLET PRESSURE GAUGE CONNECTION

Figure 5. Gauge Connections (RH Rotation Shown)

b. Connect a 5000 PSI pressure gauge at the outlet of the piston pump and on load sensing models, in the load sensing line.

c. Check pump housing to verify that it is full of system fluid.

d. Jog the engine to prime the pump, then, exercise the controls to eliminate entrained air in the system.

3. PRESSURE LIMITER ADJUSTMENT

a. Move an appropriate cylinder on the machine until it bottoms out. From the center condition, crack the control valve lever toward the bottomed out position enough to allow pressure build up in the system. DO NOT exceed the maximum pressure limit noted in Table 3. If the maximum pressure limit does not correspond to Table 3, adjustment of the control is required. Proceed to step (b) and begin adjustment.

CAUTION

DO NOT adjust control while machine is running.

b. Adjust the pressure limit set screw (clockwise to increase, counterclockwise to decrease) until the pressure noted in Table 3 is obtained. See Figure 4.

PUMP MODEL	MAXIMUM PRESSURE LIMIT	
	bar	PSIG
-C18V-30	180	2610
-C19V-30	190	2755
-C20V-30	200	2900
-C25V-30	250	3625

Table 3. Control Pressure Specifications

4. LOAD SENSING VALVE ADJUSTMENT

While slowly moving an actuator on the machine, observe pump pressure and load pressure. The difference between pump pressure and load pressure is the load sense delta p. To increase the load sensing pressure drop (delta p), rotate load sensing adjusting screw clockwise. To decrease the setting, rotate the load sensing adjusting screw counterclockwise. The standard factory setting is 300 psi delta.

If this delta p is set too low, system instability can occur. Correct this by increasing delta p.

Section IV – INSTALLATION

A. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION
Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings.

1. Direct Mounting – A pilot on the pump mounting flanges assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is NOT recommended for these pumps without engineering approval.

C. SHAFT ROTATION

CAUTION
Never drive a pump in the wrong direction of rotation. Seizure will result and cause expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with clean solvent to remove loose particles.

NOTE
For information on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube.

4. Of most concern is keeping the inlet line as large, as short and with as few bends and/or fittings as possible.

A. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening and the case drain opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak.

B. CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precaution should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

C. SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities and start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

D. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Fluid in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of fluid assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any fluid selected for use with pumps is acceptable for use with valves or motors.

Data sheet M-2950-S for fluid selection is available from any authorized distributor.

Fluid recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended fluids or operating conditions, see your sales representative.

E. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to the system, it should be pumped through a 10 micron absolute filter. The use of a porta-filter transfer unit (PFTU) to filter clean fluid into the system is recommended. For further information on the porta-filter transfer unit, obtain Service Drawing I-3952-S.

It is important that the fluid be kept clean and free from any substance that may cause improper operation or wear to the pump and other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from entering the system.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. PRODUCT LIFE

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

Section VI — TROUBLESHOOTING

The trouble shooting chart (Table 4) list common difficulties experienced with pumps and hydraulic systems. The chart indicates probable causes and remedies for each of the troubles listed.

TROUBLE	PROBABLE CAUSE	REMEDY
I. Excessive noise in pump.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended fluid. DO NOT over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	Check inlet (suction) lines and fittings for air leaks.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system at low power until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief valve open.	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair.
IV. Loss of fluid.	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating sections of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Misadjusted or broken pump control.	Adjust or replace pump control.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 4. Troubleshooting Chart

Section VII — OVERHAUL

A. GENERAL

In most cases, the pump will not require a complete overhaul as described within this section of the manual. In general, pump disassembly is accomplished according to the item number sequence as shown in Figure 10. For pump assembly, reverse the item number sequence. The item number sequence can also be used as a guide for partial disassembly and assembly. If the pump needs a complete overhaul, obtain the necessary service tools listed in Section VII-B. Repair of this unit is intricate and should not be attempted without proper tools.

B. SERVICE TOOLS

1. Standard Tools
    a. A torque wrench (50 lb. ft. max.) with a short extension.
    b. One standard socket set 5/8″ to 1″.
    c. A set of hex key wrenches with a socket adaptor.
    d. A 6″ crescent wrench.
    e. A feeler gage.
    f. A medium size screwdriver.
    g. A rubber tip hammer.
    h. A needle nose pliers.
    i. Vice grip pliers.
    j. A large nut wrench that opens to 2 inches.
    k. Internal Truarc pliers.
    l. Petroleum jelly lubricant or equivalent that is compatible with system fluid.
    m. Cleaning solvent that is compatible with system fluid.
    n. Small hammer.

2. Special Tools
    a. A dial indicator and accessories.
    b. Bearing race removal tool and shim stock. (See Figure 8.)
    c. A cylinder block spring decompression tool. (See Figure 7.)
    d. Two studs (8″ long × 0.437-14 dia./C1-2A thd. class).
    e. Shaft seal assembly tool. (See Figure 8.)
    f. Force indicator tool that will read up to 25 lb.
    g. Bearing race installation tool. (See Figure 9.)
    h. In addition to the above tools, an arbor press is required to assemble bearings. A chain fall is also recommended to handle the pump.
    i. A piece of shim stock or teflon material (8″ × 3″ × .003″).

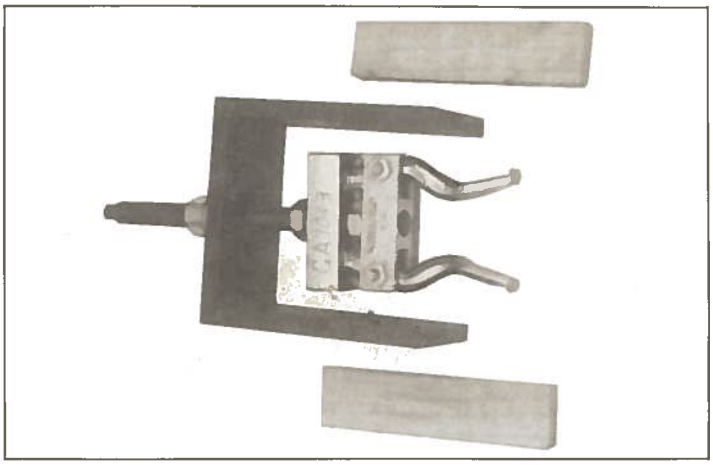


Figure 6. Valve Block Bearing Race Removal Tool and Shim Stock.

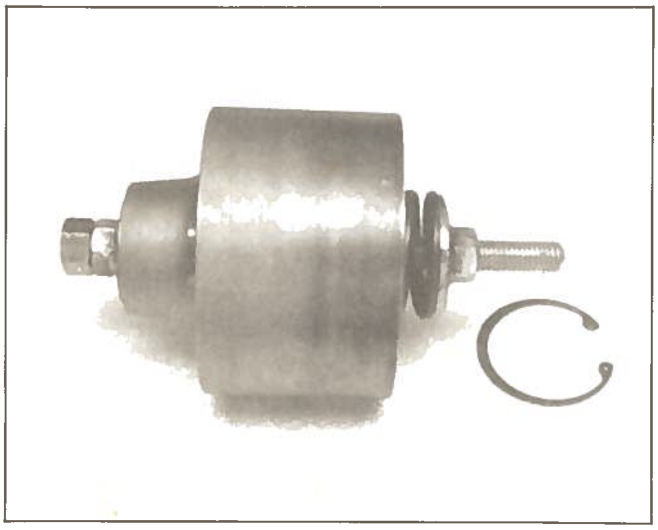


Figure 7. Cylinder Block Subassembly Dissasemly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

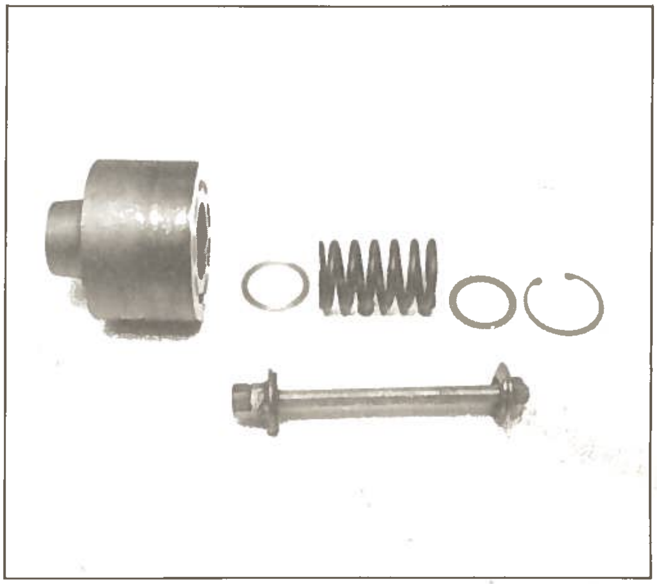
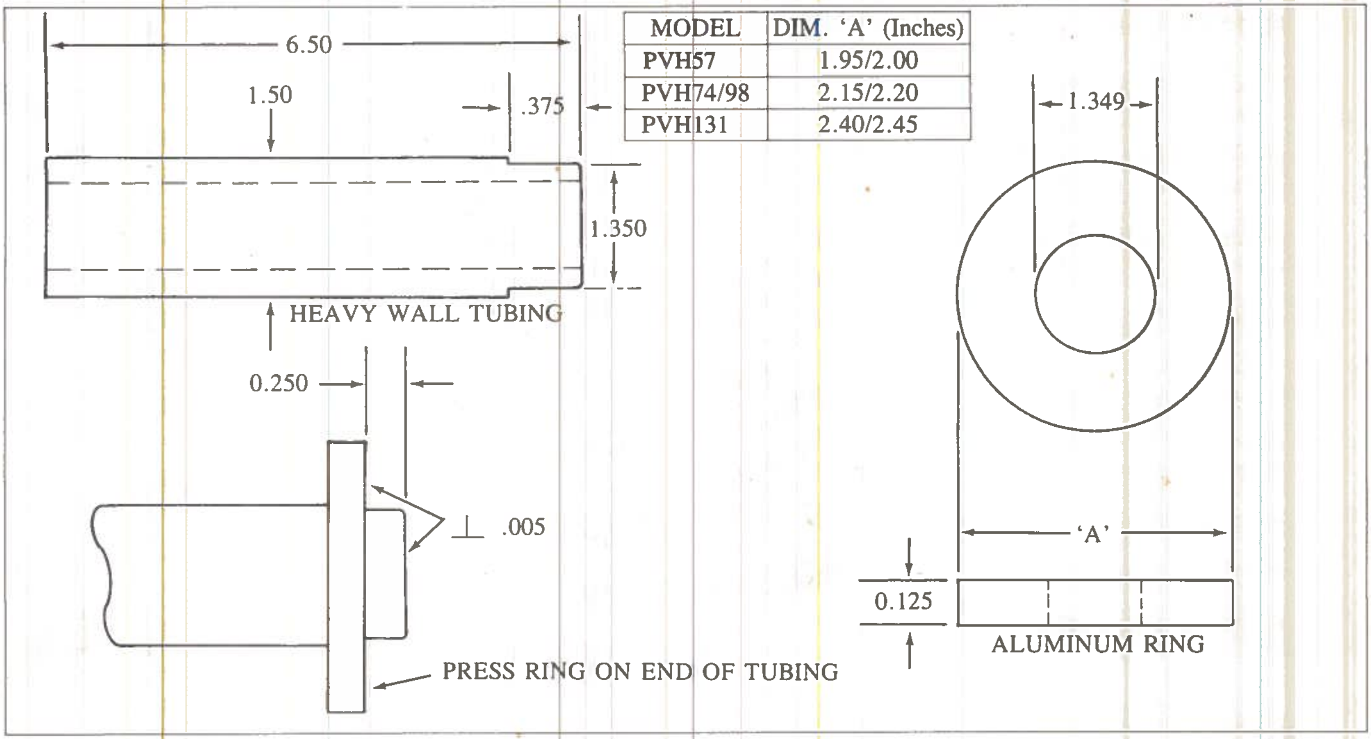
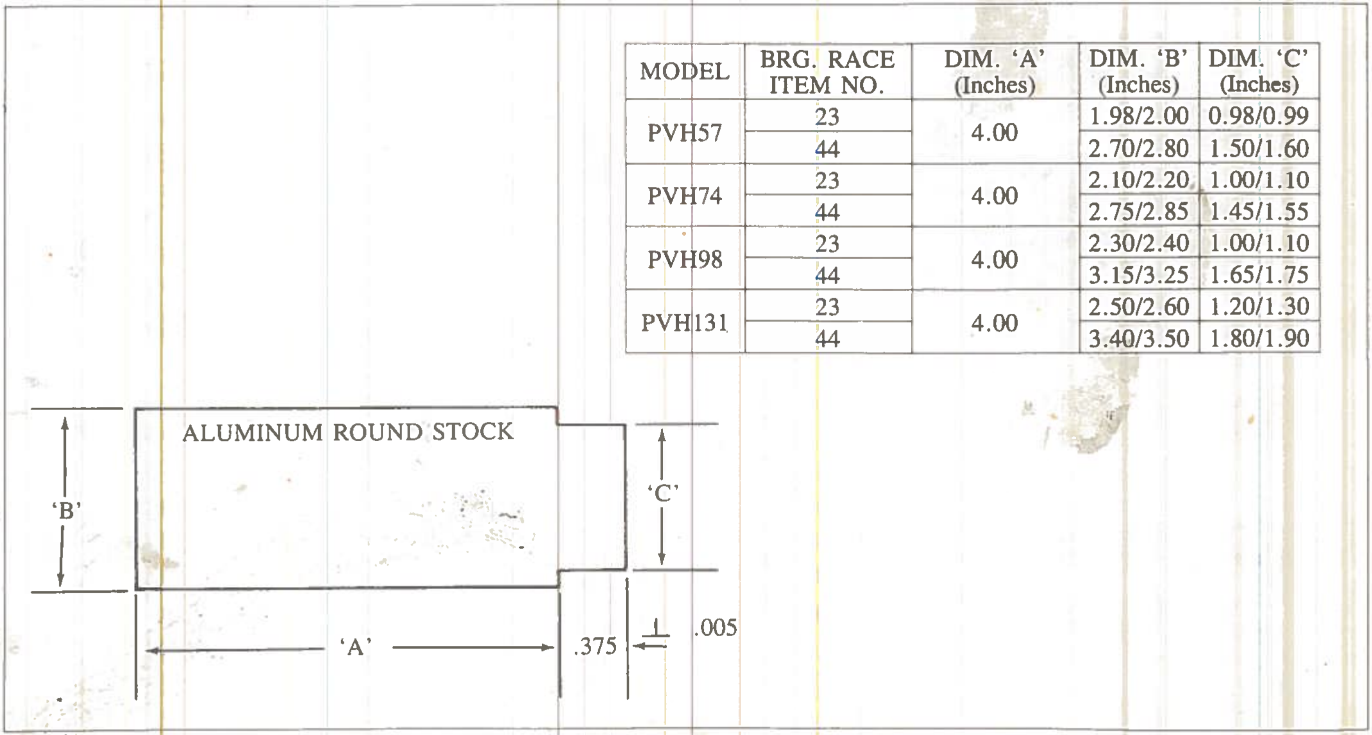


Figure 7a. Cylinder Block Subassembly Parts.



MODEL	DIM. 'A' (Inches)
PVH57	1.95/2.00
PVH74/98	2.15/2.20
PVH131	2.40/2.45

Figure 8. Shaft Seal Driver



MODEL	BRG. RACE ITEM NO.	DIM. 'A' (Inches)	DIM. 'B' (Inches)	DIM. 'C' (Inches)
PVH57	23	4.00	1.98/2.00	0.98/0.99
	44		2.70/2.80	1.50/1.60
PVH74	23	4.00	2.10/2.20	1.00/1.10
	44		2.75/2.85	1.45/1.55
PVH98	23	4.00	2.30/2.40	1.00/1.10
	44		3.15/3.25	1.65/1.75
PVH131	23	4.00	2.50/2.60	1.20/1.30
	44		3.40/3.50	1.80/1.90

Figure 9. Bearing Race Installation Tool.

C. UNIT REMOVAL (Refer to Figure 10)

1. Block the machine to prevent uncontrolled movement.

CAUTION

Before breaking the circuit connection, make sure power is off and system pressure is released. Lower all vertical cylinders, discharge accumulators, and block any load that could generate pressure.

2. Drain the fluid from the system.

3. Remove drain plug (1) from the pump's valve block (8) and drain the fluid from the pump.

4. Before breaking any circuit connections at the pump, clean the pump exterior to prevent dirt from entering the system.

5. Disconnect all hydraulic lines at the pump.

6. Remove the unit from the machine. Use a chain fall.

7. Put the unit on a clean, steel work bench that will support the unit's weight.

CAUTION

Cleanliness is essential when working on a hydraulic system or system component. Always work in a clean area. Contamination can cause serious damage to a hydraulic system.

8. Before unit disassembly, cap or plug all open circuit connections on the machine so dirt does not enter the system.

D. UNIT DISASSEMBLY

NOTE

All parts within the unit must be kept clean during the overhaul process. Handle each part with great care. The close tolerance of the parts makes this requirement very important. Clean all parts that are removed from the unit with a commercial solvent that is compatible with the system fluid. Compressed air may be used in the cleaning process, however, it must be filtered to remove water and other contamination.

Valve Block Disassembly

NOTE

Refer to Figure 10, PVH exploded view, for the following disassembly procedures.

1. Remove plug (3) and o-ring (4) from the valve block (8).

2. Loosen the six screws (5,6,7) that attach the valve block to the pump housing (51).

3. At this time, remove two screws (6 and 7) that are opposite of each other and replace these screws with two studs. The studs are referenced in Section VII-B, Special Tools.

4. Remove the remaining four screws from the valve block.

5. Remove the valve block from the pump housing.

NOTE

To dislodge valve block (8) from the housing (51), tap on side of valve block with a rubber hammer. Slowly remove the valve block away from the housing. The studs will act as a guide during this procedure. (Note: The valve plate (21) may stick to the cylinder block (29) or valve block (8) during removal of the valve block.) Be careful not to damage the valve plate or valve block during this operation. Once the valve block moves away, do not allow the valve block to move back against the pump housing (51) because the valve plate may get damaged.

6. Remove valve plate (21).

7. Remove and discard housing gasket (20).

8. Remove pins (19) from valve block (8).

9. Remove control piston (9), bias piston (12), and bias spring (13). *DO NOT* remove control rod (10), o-ring (11), bias rod (14), and o-ring (15) from valve block (8) unless they are damaged.

NOTE

If control rod (10) or bias rod (14) needs to be removed from valve block (8), secure the valve block in a sturdy vise. Make sure the vise jaws do not damage the valve block face. Insert a hex key wrench into the stem and turn the wrench counterclockwise. It may be necessary to use an extension on the wrench because the control and bias stem are secured to the valve block with Loctite 270 cement. Remove o-ring (11) and o-ring (15) from the rods.

10. Take a blunt screwdriver and push down on poppet (17). The poppet is located in the valve block face underneath seat (16).

Release the screw driver from the poppet and check to see if the poppet returns against seat (17). *DO NOT* remove seat (16), poppet (17), and spring (18) from valve block (8) if the poppet returns against the seat.

11. Remove tail roller bearing (23) and shim (22) from ends of shaft (39).

Rotating Group Removal

1. Remove the three screws (26) that hold the lower bearing cover (27) to pump housing (51). Remove lower bearing cover and o-ring (28). Discard o-ring (28). Remove upper bearing plug (24).

2. Reach in with both hands and remove the complete rotating group from the housing (51). The complete rotating group consists of items 29 through 40.

3. Remove four screws (34) and limiter plates (35) to remove the rotating group from yoke (40).

(yoke assy. consists of 2 limiter plates, 2 spacers and 4 screws)

ITEM	NOMENCLATURE	QTY
1.	Plug	1
2.	'O' Ring	1
3.	Plug	1
4.	'O' Ring	1
5.	Screw	4
6.	Screw	1
7.	Screw	1
8.	Valve Block	1
9.	Control Piston	1
10.	Control Rod	1
11.	'O' Ring	1
12.	Bias Piston	1
13.	Spring	1
14.	Bias Rod	1
15.	'O' Ring	1
16.	Seat	1
17.	Poppet	1
18.	Spring	1
19.	Pin	2
20.	Gasket	1
21.	Valve Plate	1
22.	Shim (spacer)	A/R
23.	Tail Bearing S/A	1
24.	Upper Bearing Plug	1
25.	'O' Ring	1
26.	Screw	3

ITEM	NOMENCLATURE	QTY
27.	Lower Bearing Cover	1
28.	'O' Ring	1
29.	Cylinder Block S/A	1
30.	Retaining Ring	1
31.	Spring Guide	1
32.	Spring	1
33.	Spring Guide	1
34.	Screw	4
35.	Limiter Plate	2
36.	Shoe Plate	1
37.	Piston S/A	9
38.	Spacer	2
39.	Shaft	1
40.	Yoke	1
41.	Screw	2
42.	Upper Saddle Bearing	1
43.	Lower Saddle Bearing	1
44.	Bearing S/A	1
45.	Retaining Ring	1
46.	Shaft Seal	1
47.	Drain Plug	2
48.	'O' Ring	2
49.	Screw	1
50.	Nameplate	1
51.	Housing	1

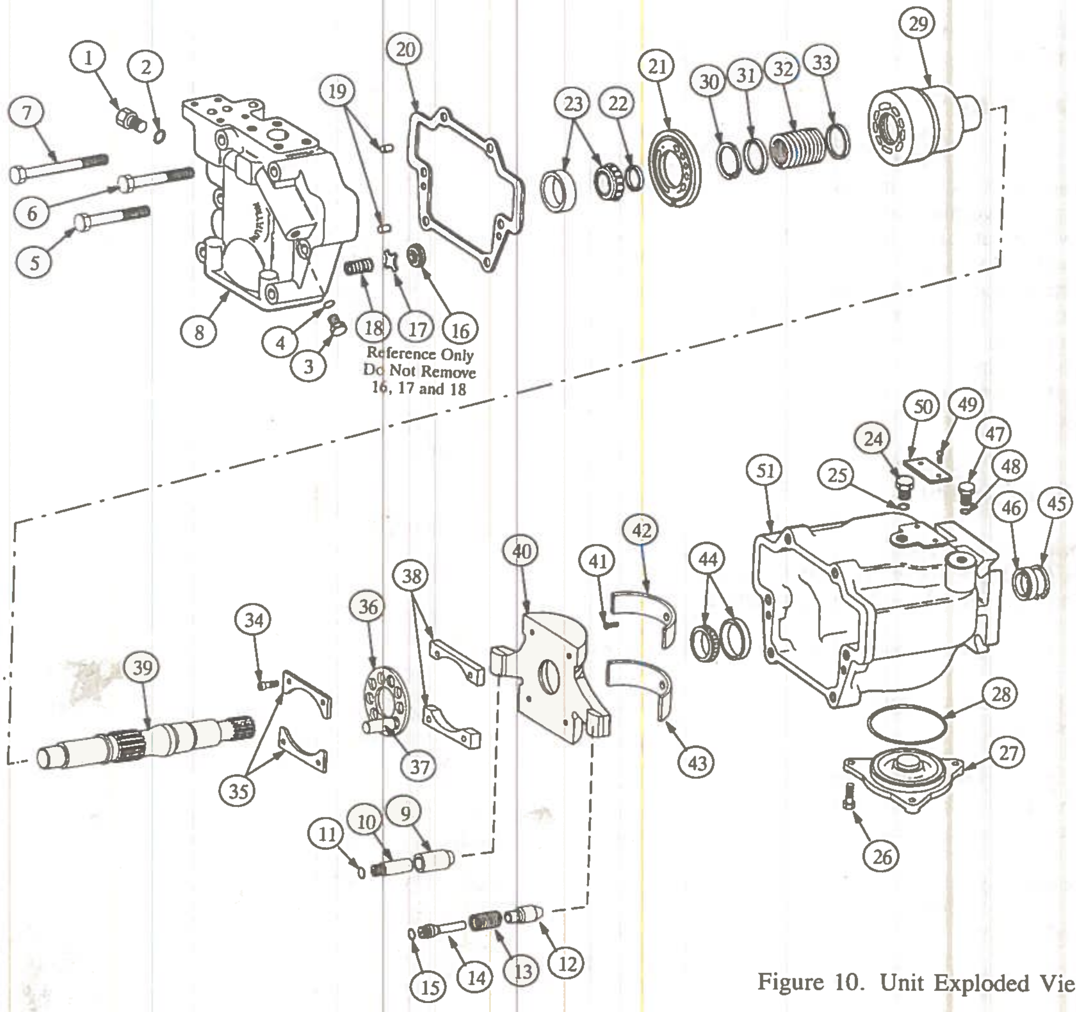
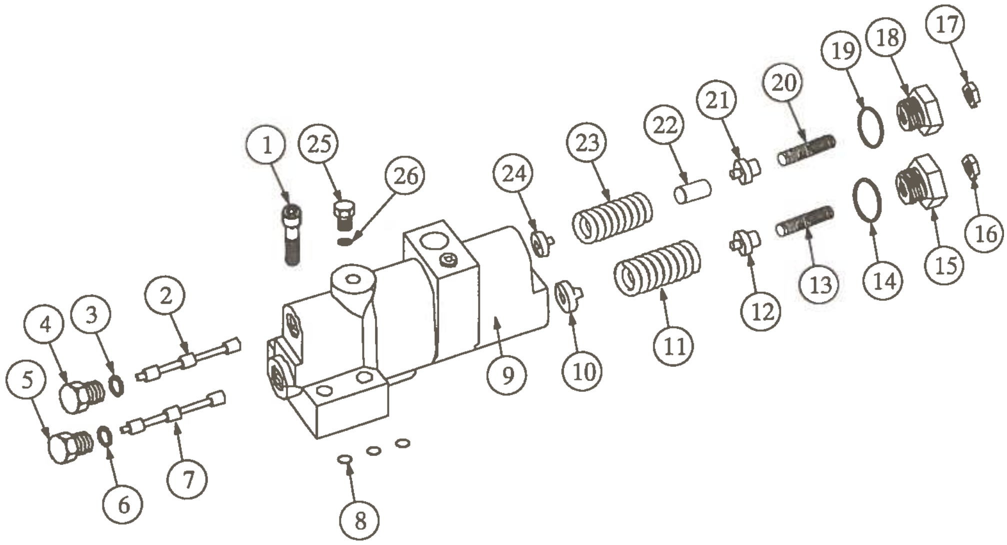


Figure 10. Unit Exploded View



Item	Description	Qty
1.	Screw	4
2.	Load Sensing Spool	1
3.	'O' Ring	1
4.	Plug	1
5.	Plug	1
6.	'O' Ring	1
7.	Press. Comp. Spool*	1
8.	'O' Rings	3
9.	Control Body	1
10.	Spring Seat	1
11.	Spring	1
12.	Spring Guide	1
13.	Adj. Screw	1

Item	Description	Qty
14.	'O' Ring	1
15.	Plug	1
16.	Nut	1
17.	Nut	1
18.	Plug	1
19.	'O' Ring	1
20	Adj. Screw	1
21.	Spring Seat	1
22.	Spring Stop	1
23.	Spring	1
24.	Spring Guide	1
25.	Plug	1
26.	'O' Ring	1

*This spool has 5 grooves versus three on Load Sensing Spool item 2.

Figure 11. CV Control Exploded View

WARNING

> *DO NOT* remove retaining ring (30) from cylinder block (29) because spring (32) is under high compression. Bodily harm may result if the retaining ring is removed without adequate caution. In most cases, the parts inside the cylinder block will not require removal. However, if spring (32) is damaged, the parts within the cylinder block must be removed. See Figure 12 for disassembly instructions.

Shaft and Yoke Removal

NOTE

> Shaft (39) removal is necessary if any of the following conditions are noted:

a. Damage at bearing surface or spline area of shaft (39).

b. Yoke (40) bind (i.e. yoke does not move freely back and forth within the pump housing.

c. Yoke shows evidence of heavy wear or cracks.

d. The yoke saddle bearing (42 and 43) surfaces are worn, scored or defective.

e. Shaft seal (46) leakage noted during pump operation.

NOTE

> If any of the above conditions are noted, perform the following steps.

1. Remove the three screws (26) from lower bearing cover (27), then remove cover and upper bearing plug (24).

2. Remove four screws (34) and limiter plates (35) so that the rotating group can be separated from yoke (40).

3. Secure housing (51) in a vise so that shaft (39) is in a horizontal position.

4. Remove shaft (39) from housing (51) by tapping on spline end of shaft with a rubber hammer.

5. Remove yoke (40) from housing (51).

6. Wash yoke (40) in clean solvent.

Bearing & Shaft Seal Removal

1. Remove roller bearing (46) from housing (51). Also remove saddle bearings (42 & 43), and inspect for wear.

2. Inspect roller bearings (23 and 44) for pitting and cracks. Turn roller bearings in their associated bearing race and check for roughness and bind. The roller bearings must turn freely within the bearing race with no signs of bind. If a roller bearing shows evidence of bind, wash the bearing in a clean solvent and recheck for bind. If binding persists, replace the roller bearing and bearing race. Refer to Figures 13 and 14 for the bearing race removal procedure.

3. Remove retaining ring (45) from housing (51) with Truarc pliers.

4. Remove shaft seal (46) from housing (51). Refer to Figure 15 for instructions.

PVH Control Disassembly (Refer to Figure 11)

1. DISASSEMBLY

CAUTION

> DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

NOTE

> In the following step if pump control is mounted at the twelve (12) o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

a. Remove drain plug (1 ¼ inch) from pump housing and drain fluid from pump. Remove all tubing connected to the control.

b. Remove the control by loosening four screws (1) (see Figure 10) that hold the control to the valve block. Remove three ''O'' rings and discard.

c. Place the control in a vise with the jaws resting on the outside of body (9).

d. Remove parts (10 through 24), then remove plugs (4 and 5) with their associated ''O'' rings (3 and 6). Slide spools (2 and 7) from the body. Discard any ''O'' rings.

2. INSPECTION, REPAIR AND REPLACEMENT

NOTE

> Replace all parts that do not meet the following specifications.
>
> All parts must be throughly cleaned and kept clean during inspection and assembly. Clean all removed parts with a solvent that is compatible with system fluid. Compressed air may be used in cleaning, but must be filtered to remove water and contamination. Clean compressed air is especially useful in cleaning body passages.

a. Inspect the threads and ''O'' ring grooves on adjustment plugs (15 and 18). If threads are worn, replace the plugs. If ''O'' ring grooves have burrs, remove the burrs with an India stone.

b. Inspect springs (11 and 23) for wear on the outside edges. Check spring ends for squareness. The spring ends must be parallel within three degrees (3 °). If spring is bent or worn, replace the spring.

c. Check spring seats (10 and 24) for burrs. Clean up with an India stone if burrs are present.

d. Check spools (2 and 7) for erosion, burrs, and scratches. If the spool is eroded or scratched across a land, check body (9) for the same problem. If erosion is heavy in both parts, replace the valve. If the spool is scratched and the scratch cannot be removed by light polishing with 500 grit paper or crocus cloth, replace both the body and spool. Clean up burrs with an India stone.

NOTE

Reliable operation throughout the specified operating range is assured only if genuine manufacturer's parts are used. Sophisticated design processes and materials are used in the manufacture of our parts. Substitutions may result in early failure.

E. INSPECTION, REPAIR, AND PART REPLACEMENT

NOTE

Before inspection of parts, clean all parts with a solvent that is compatible with system fluid.

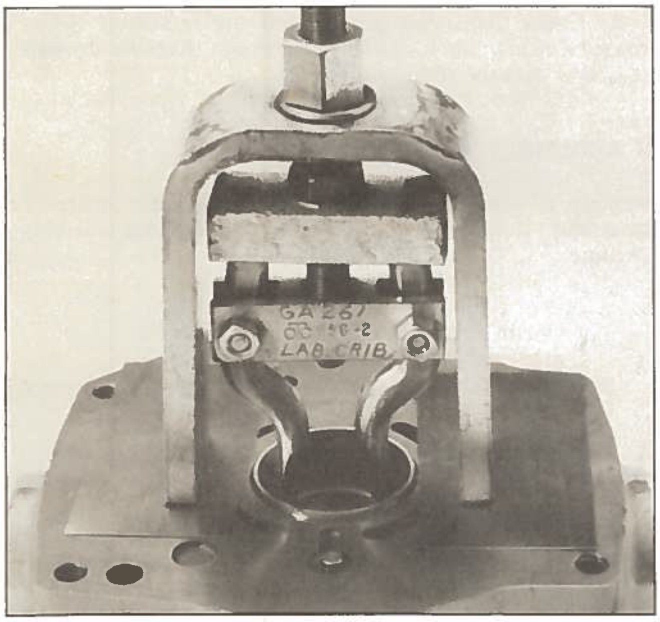


Figure 12. Removal of Bearing Race (23) from Valve Block (8).

PVH Control Parts

1. Inspect all parts for wear and/or erosion.

2. Inspect the plugs and screws for damaged threads, burrs, etc. Replace any plug or screw that has damaged threads.

3. Inspect springs for squareness. The spring ends must be parallel within three degrees (3°).

4. Check each spool for proper movement within the body S/A. A lubricated spool *must* move freely under the influence of gravity. Check the spool orifice for restriction. To clean the spool orifice, pour some clean solvent in a squeeze bottle, then apply the solvent to the nose end of the spool and observe the flow of solvent from the spool orifice.

Rotating Group Parts (Refer to Figure 10)

1. Inspect cylinder block face (8) for wear, scratches, and/or erosion. If cylinder block condition is questionable, replace the entire rotating group.

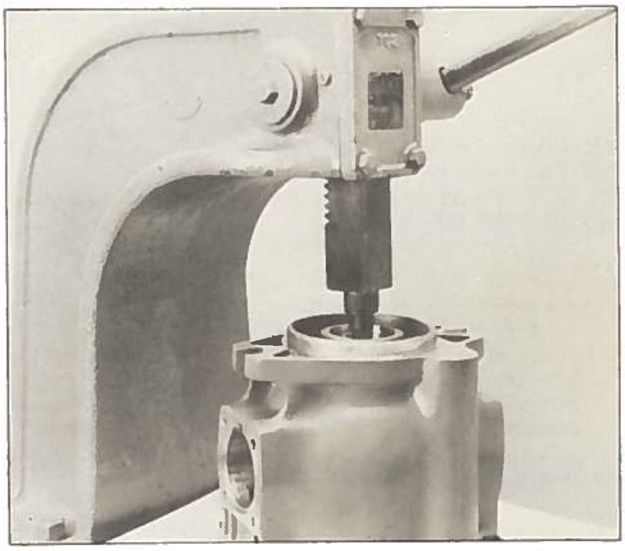


Figure 13. Removal of Front Bearing Race (44).

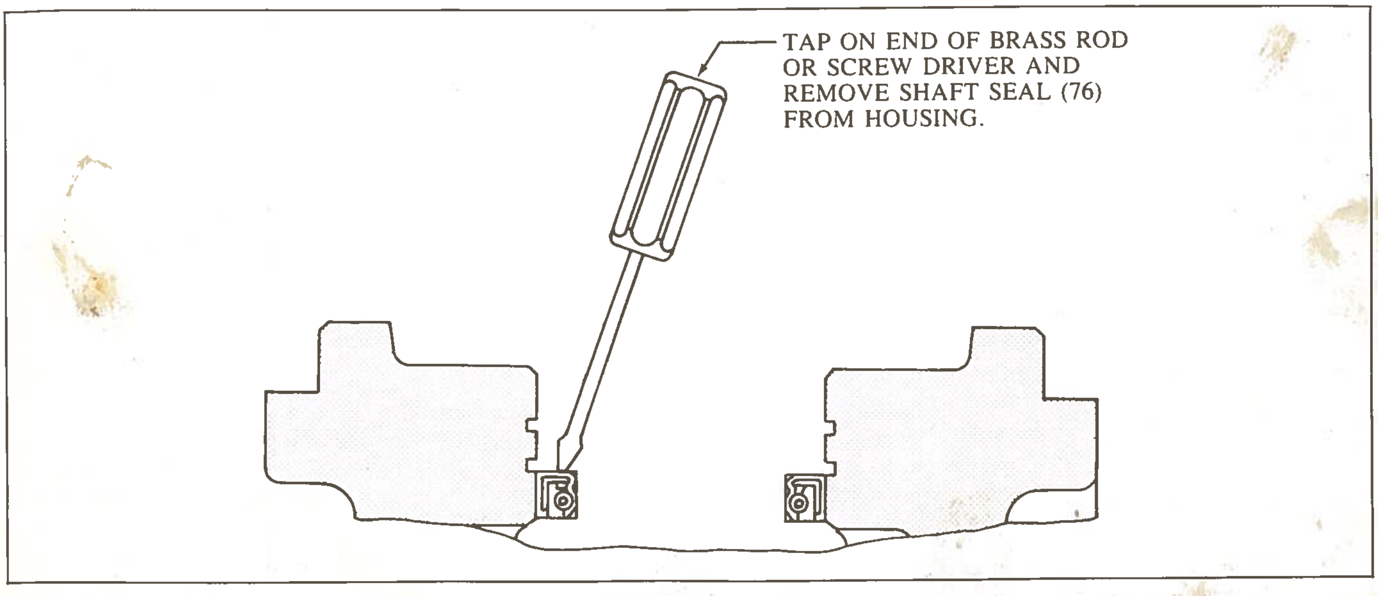


Figure 14. Shaft Seal (46) Removal.

2. Check each cylinder block bore for excessive wear. Use the piston and shoe S/A (37) for this purpose. The pistons should be a very close fit and slide in and out of the cylinder block bores. *NO BINDING CAN BE TOLERATED.* If binding occurs, clean the cylinder block and pistons. Lubricate the cylinder block bores with clean fluid and try again. Even minor contamination of the fluid may cause a piston to freeze up in a cylinder bore.

3. Inspect each of the nine piston and shoe subassemblies (31) for a maximum end play of 0.005 inch between the piston and shoe. Also check the face dimension of each shoe. The face dimension must be within 0.001 inch. See Figure 15.

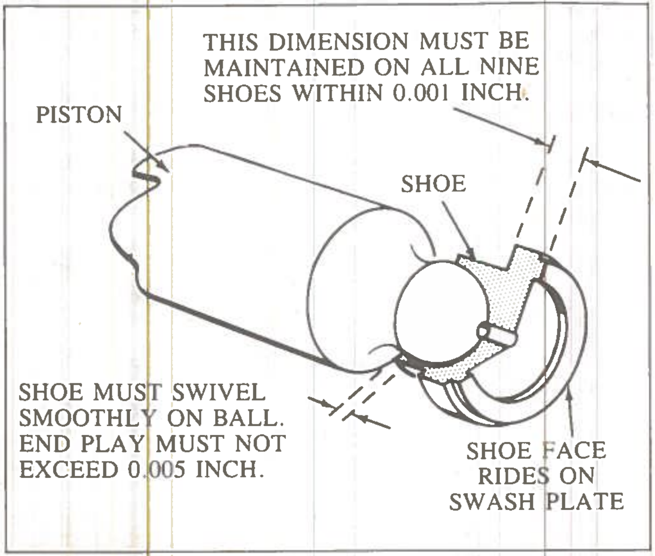


Figure 15. Piston S/A (37) Tolerances

4. Inspect the shoe plate (36) for heavy wear and cracks. If heavy wear and/or cracks are found, replace the shoe plate.

Valve Block & Associated Parts

1. Inspect valve block (8) for erosion, cracks, and burrs. Clean up minor burrs with an India stone. If erosion or cracks are noted, replace the valve block.

2. Inspect roller bearing and bearing race (23) for nicks and pitting. Make sure the roller bearing turns freely within the bearing race. If the roller bearing needs replacement, both the roller bearing and the bearing race must be replaced. To remove bearing race from valve block, refer to Figure 12.

3. Inspect valve plate (21) for erosion, excessive wear, heavy scratches, and cracks. If any of the above conditions are found, replace the valve plate.

4. Inspect control and bias piston parts (9 through 15) for burrs, scratches, and cracks. Clean up minor scratches with 500 grit paper. Remove burrs with an India stone. The control and bias piston (9, 12) should move freely over the respective control stem and bias rods (10, 14).

Yoke Parts

1. Inspect yoke (40) face for wear, roughness or scoring. Check the yoke hubs and bearing surfaces for wear and cracks. Replace yoke, if defective.

2. Inspect limiter plate (35) and spacers (38) for heavy ware and cracks. Replace if defective.

3. Inspect saddle bearing surfaces (42 and 43) for wear, pitting, and smooth operation. Replace if necessary.

Shaft / Housing Parts

1. Inspect drive shaft (39) for wear, stripped splines, and burrs. Remove burrs with an India stone. Inspect the contact area of bearing (44) and shaft seal (46). Replace the drive shaft if wear or scoring is greater than 0.005 T.I.R. (total indicator reading).

2. Inspect drive shaft bearing (44) for roughness, pitting of rollers, and excessive end play. Replace, if defective. If the bearing needs to be replaced, the bearing race inside the housing (51) also requires replacement. To remove the bearing race from the housing, refer to Figure 13.

3. Inspect housing (51) mounting flange for nicks and burrs. Remove minor nicks and burrs with an India stone. Also check the housing for damaged or stripped threads. If any thread is damaged, replace the housing.

4. Check remaining pump parts for excessive wear, damaged threads, burrs, cracks, and erosion. Replace any part that is in a questionable condition.

F. ASSEMBLY

Assembly is generally performed in the reverse order of disassembly. Refer to Figure 10 during the following assembly procedure.

NOTE

Obtain a new seal kit. Refer to the appropriate part drawing as listed in Table 2 for the seal kit part number. Apply a light film of clean hydraulic fluid to the new seals. This will make assembly easier and also provide initial lubrication of moving parts. Assemble the piston pump as follows:

1. If shaft seal (46) was removed, install a new shaft seal into housing (51). Lubricate the shaft seal and housing bore with petroleum jelly before assembly. Use an arbor press and the shaft seal assembly tool. The shaft seal assembly tool is shown in Figure 8. Make sure the spring member of the shaft seal is face up during assembly.

2. Install retaining ring (45) into the second groove within the housing bore next to the shaft seal. Use Truarc pliers for this operation.

NOTE

Bearing (race and rollers) are to be treated as one part. Therefore, when replacing bearings, install new rollers and race. Do not try to use old races over again.

3. If bearing race was removed from housing (51) install a new bearing race into housing with an arbor press. Make sure the bearing race is face up to accomodate the matching roller bearing. Press the bearing race until it rests at bottom of housing. Use the bearing race tool as described in Figure 16. After the bearing race is installed, apply a liberal amount of petroleum jelly to the matching roller bearing. Install the roller bearing into the bearing race.

4. Apply a thin coat of clean hydraulic fluid to limiter plate (35), spacers (38) and piston/shoe S/A (36 and 37). Align piston/shoe S/A (36 and 37) with yoke (40) and install using screws (34).

NOTE
The following step describes the assembly of shaft (39) into housing (51). Refer to Figure 17 during this process.

5. Install shaft (39) as follows:

a. Lubricate roller bearing (44) and shaft (39). Assemble roller bearing (44) on shaft (39).

b. Take a piece of shim stock or teflon material (8″ × 3″ × .003″) and roll it into a funnel shape. Insert the teflon material into the shaft seal (46) as shown in Figure 17.

c. Install shaft (39) into housing (51). (NOTE: The teflon material will be forced out of shaft seal during this process.)

6. If yoke (40) was removed from housing (51), assemble the yoke into housing as follows:

a. Place the pump housing on its side with saddle bearing surface (42 and 43) area of the housing face up.

b. Insert yoke (40) into housing (51).

c. Lubricate yoke bearing surfaces (42 and 43) with clean hydraulic fluid. Orient the bearing to match the bearing race. Next, carefully insert the yoke into the pump housing. *DO NOT* force the yoke into place if it does not fit properly. Align the yoke bearing surfaces with the saddle bearings.

NOTE
The following step describes the shaft and end play procedure. This procedure is necessary to insure proper pump operation. Final shaft end play must be 0.001-0.004.

7. Obtain a shaft spacer kit as noted in the parts drawing.

Perform the following steps:

a. If bias and control parts (12 through 15) are attached to valve block (8), remove parts.

NOTE
The bias and control rods must be bonded to the valve block during assembly, using a suitable bonding compound.

b. If pins (19) were removed, install two new pins into valve block (8).

c. Install housing gasket (20) against valve block (8).

d. Install tail bearing (23) on end shaft (39) so the bearing rollers match up with bearing race within the valve block (8).

NOTE
If bearing race was removed from valve block, install a new bearing race into valve block. *DO NOT* reuse bearing races with new rollers. Refer to Figure 16 for instructions.

e. Position valve block (8) on the two studs and carefully slide the valve block against housing (51). Make sure mounting pins (19) engage properly into valve block.

f. Apply a small amount of hydraulic fluid to screws (5 through 7) threads. Secure the valve block (8) to housing (51) with six screws (5 through 7). Tighten screws to 63.8 - 77.8 Nm.

g. Set the pump on the work bench so that shaft (39) is straight up (vertical). Push down on shaft to insure bearings (23 and 44) are seated.

h. Place a dial indicator at end of shaft (39). Set the dial indicator to 0.00.

i. Place vise grip pliers underneath shaft spline and lift up on shaft (39).

j. Observe the dial indicator reading to determine the amount of shaft movement. For example, if dial indicator needle reads 0.040, a 0.036-0.039 shim (22) thickness must be added to end of shaft to obtain a 0.001-0.004 shaft end play (0.040 minus 0.036-0.039 equals 0.001-0.004). Repeat this step two times to insure a proper measurement.

k. Remove valve block (8) from housing (51). Remove tail bearing (23) from end of shaft (39).

l. Install shim (22) to end of shaft (39) according to the measurement obtained in step ‘j’.

m. Install tail bearing (23) on end of shaft (39) next to shim (22).

n. Repeat steps ‘a’ through ‘j’. If 0.001-0.004 shaft end play is obtained, proceed to step ‘o’.

o. Remove valve block (8), tail bearing (23), and shim (22) from pump. Set these parts aside for final assembly.

8. Remove lower bearing cover (27) and upper bearing plug (24) from housing (51).

9. If required, assemble rotating group parts 29 through 40 into cylinder block (29). Use the spring decompression tool as shown in Figure 7.

10. Lubricate cylinder block (29) with clean hydraulic fluid. Install the nine piston subassemblies (37) into shoe plate (36) as shown in Figure 15.

11. Feed the nine pistons (37) into the cylinder block bores. Then install rotating parts 29 through 40.

12. Align rotating group with the yoke (40) subassembly. Add spacers (38) and limiter plates (35) and attach to yoke (40) with four screws (34). Seat yoke (40) on saddle bearings (42 and 43).

13. Install upper bearing plug (24) and lower bearing cover (27) and tighten three screws (26) to 7.5 - 9.5 Nm.

14. Install tail bearing (23) on shaft (39) next to shim (22).

15. If required, assemble o-ring (15) on bias rod (14) and o-ring (11) or control rod (10). Apply one drop of Loctite 270 cement to bias and control rod threads. Install the bias and control rods into valve block (8). Secure the stems with a hex key wrench.

16. Assemble spring (13) and piston (12) on bias rod (14). Install piston (9) on control rod (10).

17. Insert pins (19) into valve block (8).

18. Lubricate valve block face with a light film of clean hydraulic fluid.

19. Place valve plate (21) on valve block face with bronze side face up.

20. Carefully assemble valve block (8) onto housing (51). Make sure the bias spring (13) and bias piston (12) are in place against the yoke subassembly during the assembly process. If the spring or piston falls off the bias rod (14), apply a liberal amount of petroleum jelly to the spring and piston to hold them in place.

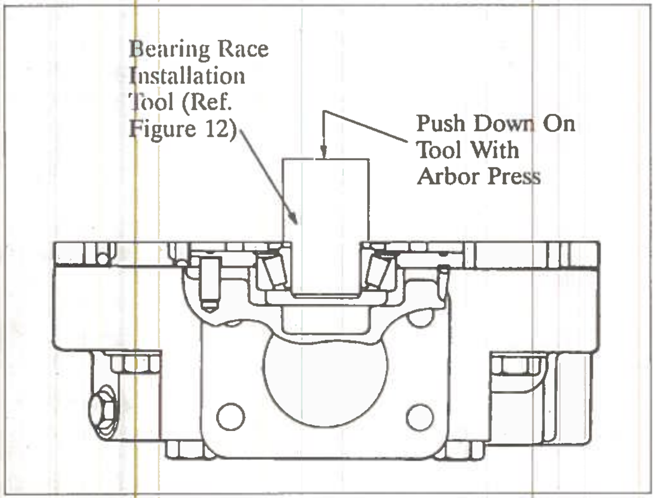

Bearing Race Installation Tool (Ref. Figure 12)
Push Down On Tool With Arbor Press

Figure 16. Installation of Bearing Race (23) into Valve Block (8)

21. Install screws (6 and 7) hand tight. Remove the two 8″ alignment studs from housing (51) and install the remaining two screws (5). Cross tighten the screws to 63.8-77.8 Nm.

22. Assemble o-rings (2 and 3) on plugs (1 and 3). Install the plugs into valve block (8). Tighten the plugs to valve noted in Table 6.

G. PVH CONTROL ASSEMBLY

LOAD SENSING

NOTE

Refer to Service Drawing for the control seal kit. Replace all seals with new ones from the kit. Assembly of parts will be in reverse item number sequence. Special assembly procedures will be noted in the step-by-step procedure.

Lubricate all parts with system fluid at assembly. "O" rings may require a viscosity improver to facilitate easier assembly.

1. Assemble spools (2 and 7) into valve body (9) with rounded end of spool pointing toward adjustment plug end of valve. Pressure compensating spool (7) has five grooves versus three on the load sensing spool (2). Make sure to note this distinction for proper assembly. Assemble "O" rings (3 and 6) on plugs (4 and 5) and on plugs (15 and 18) then thread plugs (4 and 5) into body (9). Torque plugs to 9.8-10.2 N.m (7-7.5 lb. ft.).

2. Install parts (10 through 24) in the order shown in Figure 11.

3. Install plugs (15 and 18) with their "O" rings over spring guides (12 and 21). Make sure adjusting screws (13 and 20) are threaded through plugs (15 and 18). Make sure these adjusting screws are lubricated.

NOTE

Final adjustment of the load sensing valve will be accomplished after installation of control to the piston pumps. Refer to Section VIII.E page 24.

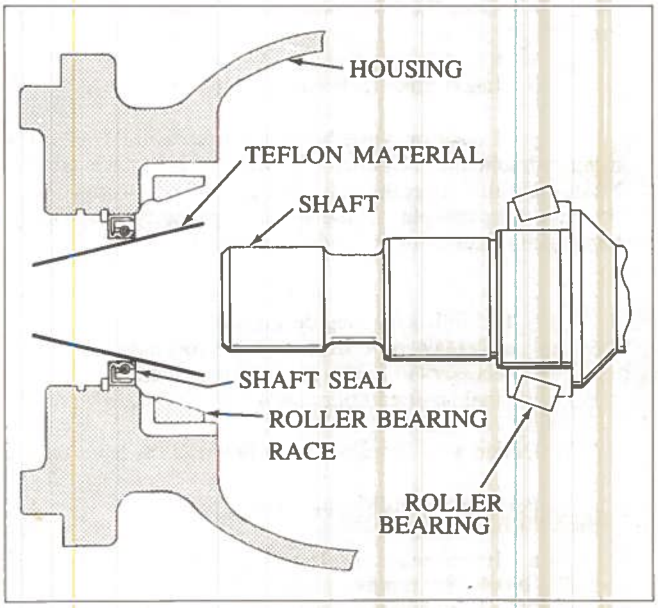


Figure 17. Shaft (39) Installation

MODEL	PLUG	TORQUE (Nm)	TORQUE (lb./ft.)
PVH57/74	4, 5 25	18 - 20	13 -15
	1 (Fig. 10)	54 - 59	40 -43
	3 (Fig. 10)	15 - 16	11 - 12
PVH98	4, 5 25	18 - 20	13 - 15
	1 (Fig. 10)	75 - 83	55 - 61
	3 (Fig. 10)	15 - 16	11 - 12
PVH131	1 (Fig. 10)	41 - 19	30 - 36
	3 (Fig. 10)	14 - 19	10 - 14

Table 5. Plug Torque

A. TEST CONDITIONS

1. Fluid entering the pump inlet must be filtered to meet an ISO (International Standard Organization) cleanliness code of 19/15 or cleaner. Selections from OFP, OFR and OFRS series filters are recommended. For recommended fluid types, refer to bulletin M-2950-S.

2. Pump inlet pressure must be maintained between 1.15 bar and 0.85 bar absolute pressusre (2 PSIG-5 inches Hg).

3. Operate the pump at a fluid temperature of 120°F ± 10°F.

4. PVH operating parameters are listed in Table 6.

PUMP MODEL	RATED PRESSURE (PSI)	RATED SPEED (RPM)	RATED DISPLACEMENT (CIR)
PVH57	3600	2400	3.5
PVH57QI	3600	1800	3.5
PVH74	3600	2200	4.5
PVH74Q	3600	2100	4.5
PVH74QI	3600	1800	4.5
PVH98	3600	2100	6.0
PVH98QI	3600	1800	6.0
PVH131	3600	2000	8.0
PVH131QI	3600	1500	8.0

Table 6. PVH Operating Parameters

B. PRELIMINARY SET-UP

1. If a hydraulic test stand is available with adequate horsepower capabilities, mount the pump on the test stand. If a test stand is not available, mount the pump on the vehicle and proceed to connect the hydraulic lines to the pump. Refer to Section IV for pump installation instructions.

2. Connect the case line, inlet and outlet line, load sensing line (if required), pressure gauges, and other equipment as described in Figure 18. Make sure all connections are tight.

3. Remove drain plug (1) from valve block (8) and fill the pump with clean hydraulic fluid. Reinstall the plug and torque to value noted in Table 6.

NOTE

The following step describes the preliminary setting of the PVH control adjustment screws (20, 13) prior to test. Refer to Figure 11 for screw locations.

4. Turn the control adjustment screws as follows:

PVH57/74/98/131 pump with 'CV' control: Turn load sensing screw (20) clockwise until it bottoms out. Turn pressure compensator screw (13) clockwise until it bottoms out, then back off on screw (13) two full turns.

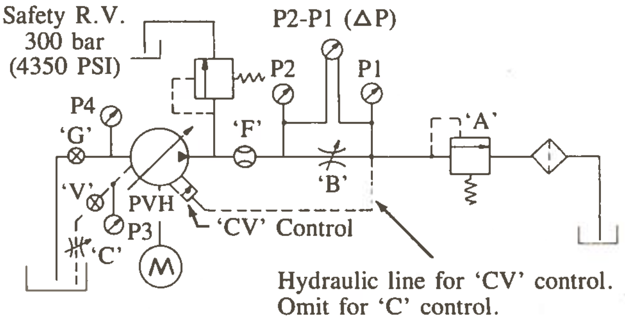
C. START-UP

NOTE

Refer to Figure 18 during the following discussion.

'A' = Load Valve
'B' = Flow Control or Load Sensing Valve
'C' = Internal Check Valve
'G' = Globe Valve (Inlet)
'V' = Needle Valve
'F' = Flow Meter

P1 = Pressure Gauges (5000 PSI)
P2 = Pressure Gauge
P3 = Case Drain Pressure Gauge
P4 = Inlet Pressure Gauge



Hydraulic line for 'CV' control. Omit for 'C' control.

Note: Valve 'B' and pressure gauge P1 not required for PVH with 'C' control.

Figure 18. PVH Test Circuit

1. Fully open valve 'G' and 'V'.

2. Fully open valve 'B' and set valve 'A' to minimum pressure setting.

3. Start the test stand or vehicle engine. Operate the pump at 600 RPM and at minimum outlet pressure. Check the system for leaks and unusual noise. Increase the pump to 1200 RPM until all the air is purged out of the system.

CAUTION

If unusual noise is noted, shut down the system immediately to avoid pump damage. Refer to the Troubleshooting Chart (Table 4) for possible repair solution.

D. PERFORMANCE TEST

NOTE

Refer to Figure 18 during the following discussion.

1. Increase the pump to the rated speed (RPM) as specified in Table 6. Adjust valve 'A' until 28 bar (400 PSIG) outlet pressure is obtained at 'P2'. Hold this condition until the air is purged out of system.

2. Increase the outlet pressure to 150 bar (2175 PSIG). Hold this condition for one minute. Reduce the outlet pressure to 28 bar (400 PSIG) and observe the pump flow from flowmeter "F". Pump flow must meet the requirement as stated in Table 7 when the fluid temperature at pump outlet is 120°F ± 10°F.

PUMP MODEL	RATED SPEED (RPM)	FLOW @ 28 bar (400 PSI)	MAX. FLOW LOSS @ 250 bar (3625 PSI)
PVH57	2400	130 - 144 l/m (34.3 - 38.0 GPM)	12 l/m (3.2 GPM)
PVH57QI	1800	95.8 - 10.9 l/m (25.3 - 29.3 GPM)	12 l/m (3.2 GPM)
PVH74	2200	154.1 - 171.0 l/m (40.7 - 45.2 GPM)	13 l/m (3.4 GPM)
PVH74Q	2100	145 - 160 l/m (38 - 42 GPM)	13 l/m (3.4 GPM)
PVH74QI	1800	126.1 - 139.2 l/m (33.3 - 36.8 GPM)	13 l/m (3.4 GPM)
PVH98	2100	196 - 216 l/m (51.8 - 57.1 GPM)	17.5 l/m (4.6 GPM)
PVH98QI	1800	167.5 - 186.4 l/m (44.2 - 49.2 GPM)	17.5 l/m (4.6 GPM)
PVH131	2000	249 - 275 l/m (65.8 - 72.6 GPM)	22 l/m (5.8 GPM)
PVH131QI	1500	187 - 207 l/m (49.4 - 54.7 GPM)	22 l/m (5.8 GPM)

Table 7. Flow Specifications

3. Increase the pump outlet pressure to 250 bar (3625 PSIG). The pump must be able to meet the flow loss requirement as stated in Table 7. Hold this condition for one minute.

4. Visually inspect shaft seal (46) for leakage throughout the performance test.

E. 'CV' CONTROL ADJUSTMENT PROCEDURE

NOTE

To adjust the 'CV' control, perform steps 1 through 7. Refer to Figures 11 and 18 during the adjustment procedure. Turn the adjusting screws clockwise to increase pressure and counterclockwise to decrease pressure.

1. Perform the preliminary set-up procedure (Section VIII-B), start-up procedure (Section VIII-C), and the performance test (Section VIII-D).

2. Set the pump to rated RPM as shown in Table 6.

3. Adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

4. Adjust valve 'B' to obtain an outlet flow that is specified in Table 8.

5. Turn load sensing screw (15) until 20 ± 1 bar (290 ± 14.5 PSID) pressure differential is obtained between 'P2' and 'P1'. Tighten nut (14).

6. Open valve 'B' and adjust valve 'A' to obtain 250 bar (3625 PSIG) at 'P2'.

7. Turn pressure compensator screw (4) until pressure at 'P2' starts to decay below 3625 PSI. Adjust screw (4) to a desired pressure level. If a pressure level is not specified, adjust the screw to 250 bar (3625 PSI).

PUMP MODEL	RATED SPEED (RPM)	PUMP OUTLET FLOW FOR SETTING ΔP
PVH57	2400	70 l/m (18.5 GPM)
PVH57QI	1800	50 l/m (13.2 GPM)
PVH74	2200	80 l/m (21.0 GPM)
PVH74Q	2100	75 l/m (19.8 GPM)
PVH74QI	1800	65 l/m (17.2 GPM)
PVH98	2100	105 l/m (27.7 GPM)
PVH98QI	1800	90 l/m (23.8 GPM)
PVH131	2000	130 l/m (34.0 GPM)
PVH131QI	1500	144 l/m (38.0 GPM)

Table 8. Outlet Flow Setting

F. STABILITY AND INTERNAL CHECK VALVE TEST

NOTE

Refer to Figure 18 during the following discussion.

1. Adjust valve 'A' to obtain 28 bar (400 PSIG) outlet pressure at 'P2'. Operate the pump at rated speed (RPM) as stated in Table 6.

2. Close valve 'A' rapidly. There shall be no indication of pump instability. (Note: Pump instability is established when outlet pressure oscillations exceed ± 3.5 bar (50 PSI) around the control pressure setting (3625 PSI). When valve 'A' is closed, the pressure at 'P2' shall be within ± 4.0 (58 PSI) of the initial pressure setting.

3. Close needle valve 'V'. The differential pressure between 'P3' and 'P4' must be 0.9-1.7 bar (13-25 PSID). Open needle valve 'V'.

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2 January 1992

PVH DISASSEMBLY / ASSEMBLY

AMERICAS MARKETING BULLETIN: AMB-92-01

There has been a great deal of confusion surrounding the acceptability of disassembling and reassembling the PVH piston pump series, particularly regarding disassembly for purposes of changing rotation. The intent of this bulletin is to clarify the policy and cautions of doing this.

The PVH piston pumps series, as with most all hydraulic equipment, is designed with very close tolerances and very critical assembly specifications such as bearing preloads, shaft end-play, bolt torques, etc. Disassembly of the PVH piston equipment should not be attempted except under very clean conditions and with proper tools, as explained in Vickers' Overhaul Manual M-2210-S, a copy of which is enclosed for your reference.

Under the proper conditions, the PVH can be disassembled for purposes of changing rotation. The parts required include a new valve block (item 8, figure 10, on page 12 of the Overhaul Manual), valve plate (item 21), control rod (item 10), bias rod (item 14) and tail bearing subassembly set (item 23). A complete seal kit will also be required, and a new nameplate (item 50) should also be used to identify the new model code.

Factory installed control and bias rods are threaded and bonded to the valve block with an adhesive compound, and cannot be removed without damaging them. Therefore, new ones must be installed and secured to the new valve block in the same manner, as described in the reassembly instructions in the Overhaul Manual. Complete step-by-step instructions are provided on pages 16 and 17, including the recommended type and brand of adhesive to use. Please note that all parts that are to be bonded must be completely free of any dirt, oil or oil residue prior to applying the adhesive. A degreasing and cleaning agent that leaves no residue must be used. Follow the instructions of the adhesive manufacturer closely.

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Service Parts Information

HEAVY DUTY
PISTON PUMP
STANDARD/
THRU DRIVE

PVE47QI*-**-(M)(D)-22-C(*)V-21

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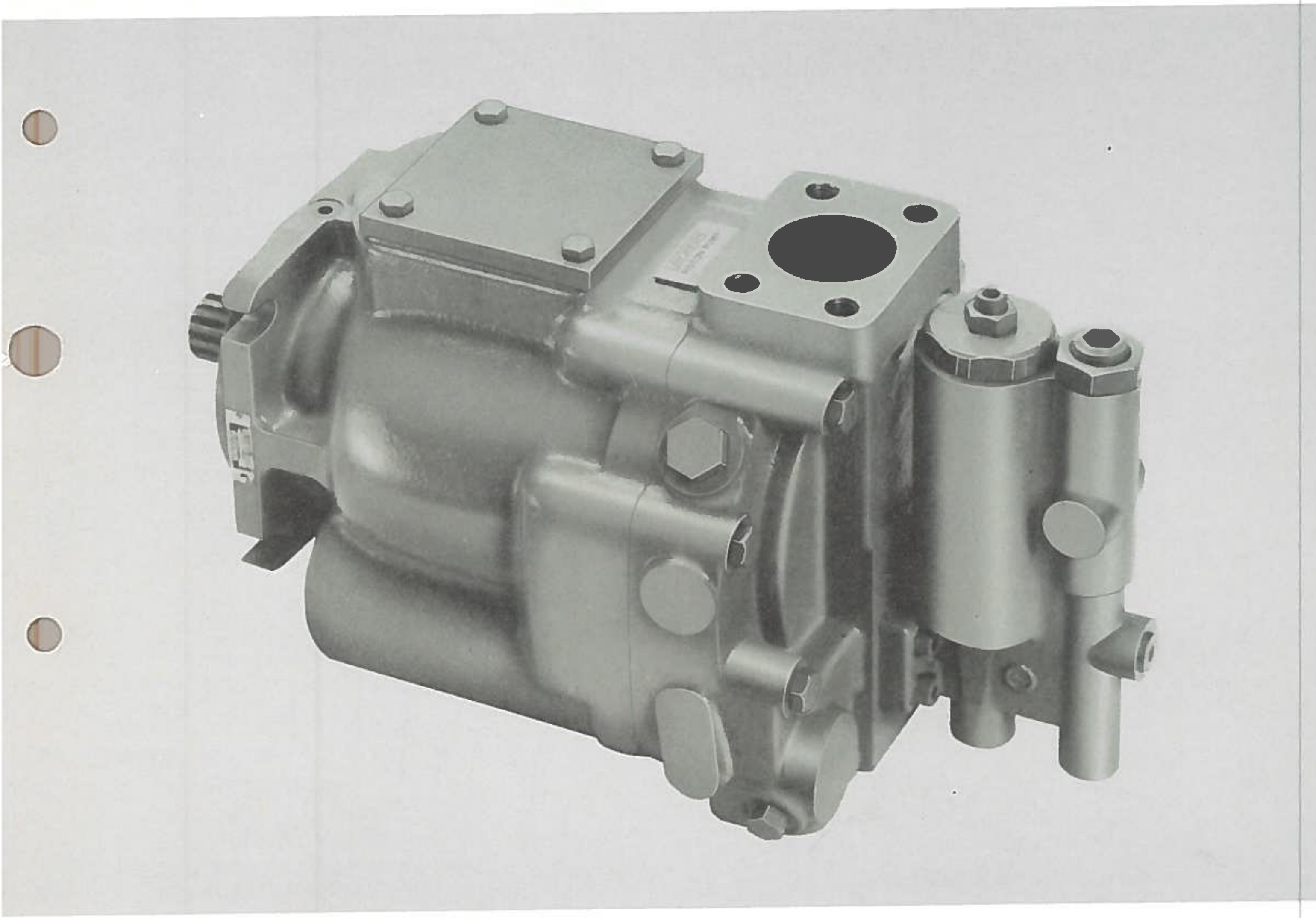

Vickers, Incorporated

1401 Crooks Road
Troy, Michigan 48084

Released 8-1-88 **M-2237-S**

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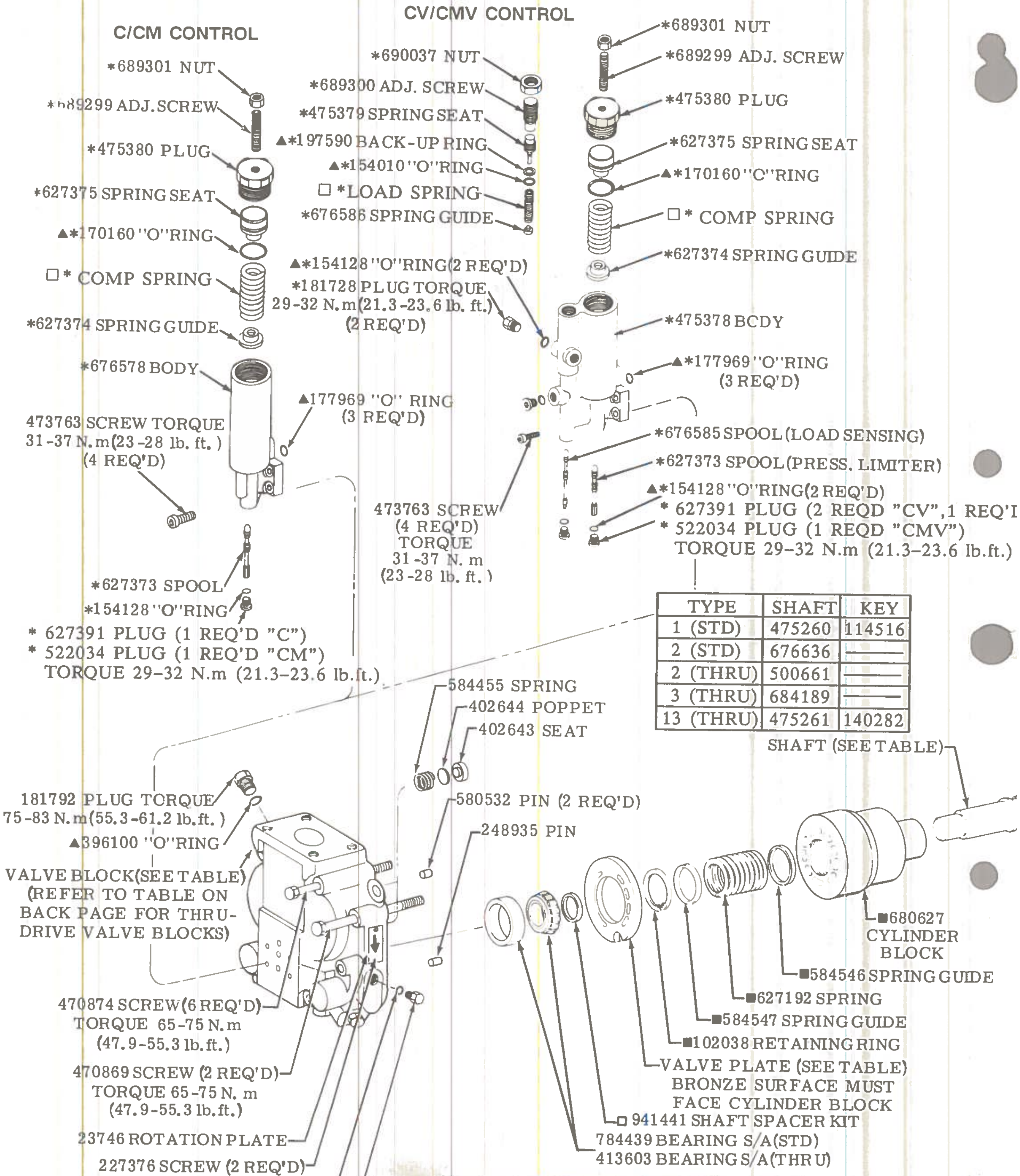


TYPE	SHAFT	KEY
1 (STD)	475260	114516
2 (STD)	676636	———
2 (THRU)	500661	———
3 (THRU)	684189	———
13 (THRU)	475261	140282

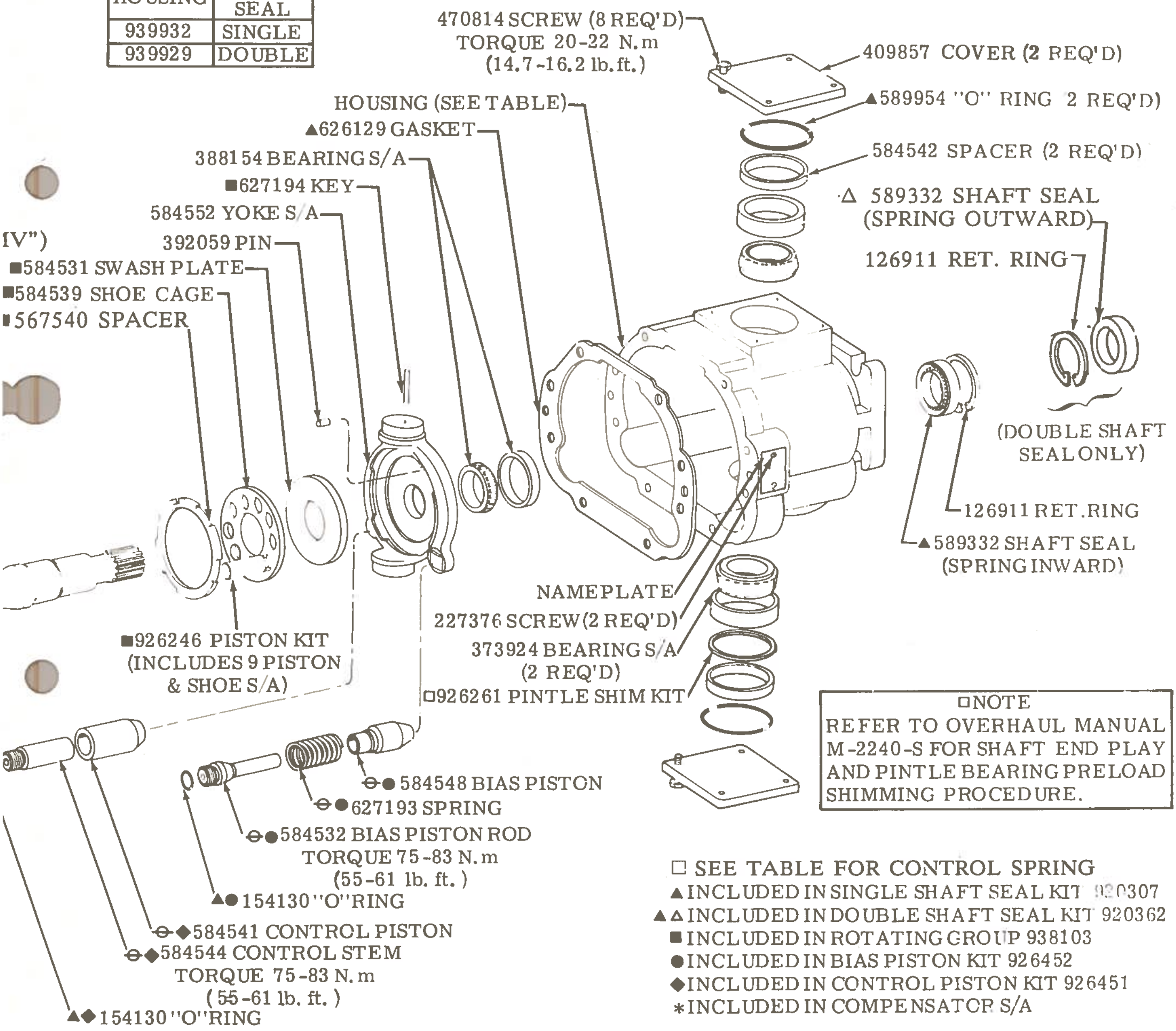
MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE47QI-L	939939	———	514120
PVE47QI-R	939941	939796	514122

ALL SEA
IN DOUB

PVE47QI*-**-(M)(D)-22-C(*)V-21

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)

HOUSING	SHAFT SEAL
939932	SINGLE
939929	DOUBLE



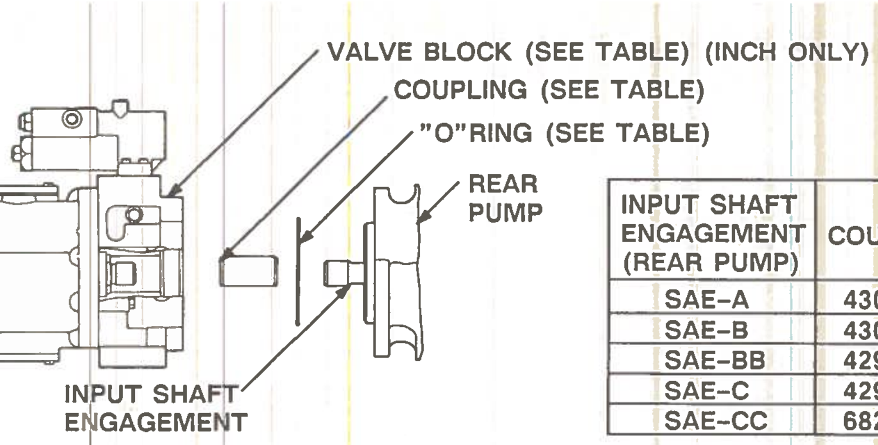
☐NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

☐ SEE TABLE FOR CONTROL SPRING
▲ INCLUDED IN SINGLE SHAFT SEAL KIT 920307
▲Δ INCLUDED IN DOUBLE SHAFT SEAL KIT 920362
■ INCLUDED IN ROTATING GROUP 938103
● INCLUDED IN BIAS PISTON KIT 926452
◆ INCLUDED IN CONTROL PISTON KIT 926451
∗ INCLUDED IN COMPENSATOR S/A

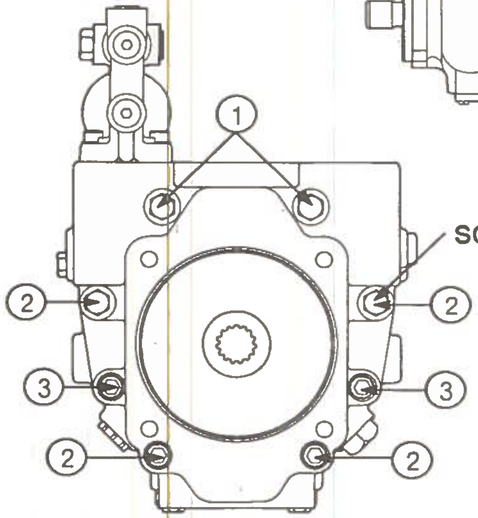
TE
ARKED ▲ INCLUDED
HAFT SEAL KIT.

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION.

THRU-DRIVE MODELS



INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	430359
SAE-B	430360
SAE-BB	429368
SAE-C	429369
SAE-CC	682898



SCREW NO.	QTY	SCREW
1	2	470876
2	4	470874
3	2	470869
TORQUE 50-55N.m (36.8-40.5 lb. ft.)		

MODEL	AUX. MTG. PAD	VALVE BLOCK (THRU-DRIVE)	"O"RING
PVE47L	A	939974	576601
PVE47R	A	939993	
PVE47L	B	939946	401525
PVE47R	B	939980	
PVE47L	C	939948	353264
PVE47R	C	939950	
PVE47RHM	A	500691	———

MODEL CODE BREAKDOWN

P V E 47(QI) * - * * (M) (D) - 22 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

47 - 47 GPM @ 1800 RPM (6.0 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
A - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

1 - STRAIGHT KEYED
2 - SPLINED
3 - SPLINED
13 - STRAIGHT KEYED

9 PORT DESIGNATION

(4 BOLT FLANGE)
BLANK - SAE I-518
M - ISO/DIS 6162

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

Litho in U.S.A.

7. Adjust load valve one (1) for pressures noted in Table 8. Check the delivery loss by comparing flow at the highest system pressure setting to the flow at 100 Psig. (Note: CVP and CVPC compensators may require an adjustment to obtain a full stroke at system pressure.) Make sure relief valve three (3) is not bypassing fluid to tank. The unit must meet the following requirements at full stroke and 1200 RPM.

SYSTEM PRESSURE	Psig	DELIVERY LOSS	MAX. CASE LEAKAGE
MODEL CODE			
PVE12*–*–**–CVP/ CVPC/CVPD	3000	1.15 USgpm	1.12 USgpm
PVE19*–*–**–CV–10	3000	1.5 USgpm	1.45 USgpm
PVE19*–*–**–CVP/ CVPC–12	3000	1.65 USgpm	1.70 USgpm
PVE21*–*–**–CV–10	2700	1.5 USgpm	1.45 USgpm
PVE21*–*–**–CVP/ CVPC–12	2700	1.65 USgpm	1.70 USgpm

Table 8. Delivery loss and maximum case leakage.

8. Units with a CV, CVP or CVPC compenstor S/A shall perform the compensator control and integral case to inlet test. Refer to steps F1 through F6. Set compensator pressure as shown in Table 6.

H. LOAD SENSING CONTROL TEST

1. At 1200 rpm, load the pump outlet port pressure to 2000 +/– 50 Psig with load valve #1. Adjust the load sensing compensator spool to obtain a differential pressure P1–P2 per Table 9 with globe valve V1 adjusted for outlet flow per Table 9 and gauge P1 at 2000 Psig.

2. Vary the outlet flow from 0.5 USGPM to maximum with globe valve one (1). Pump outlet pressure must be stable.

3. Set globe valve one (1) fully open. Differential pressure P2 - P1 will be at minimum. Slowly close globe valve V1 while observing the differential pressure gauge P2 - P1 and flow rater Q1. A point will be reached (compensator cracking pressure) where flow will start to diminish; pressure gauge P2 - P1 should read the value noted in Table 9.

4. Cycle the pump from minimum to maximum flow with globe valve one (1), pump outlet must be stable. At minimum pump flow, the standby pressure P2 after P1 has decayed to zero (0) must correspond to Table 9. Lockwire the compensator adjustment plug.

5. Check for external leakage (none permissible).

6. Disconnect and drain the unit under test. Plug all openings to prevent contamination.

MODEL	COMPENSATOR PRESSURE SETTING Psig	LOCKWIRE	STANDBY PRESSURE P2	ΔP@ USgpm (P2–P1)	ΔP@ COMPENSATOR CRACKING PRESSURE (P2–P1)
PVE12*–*–**–C**VP11	3000	Yes	250 psi Max.	160 psi ± 20 psi 4 USgpm	160 psi $^{+5}_{-20}$ psi
PVE12*–*–**–C**VPC24	3000	Yes	500 psi Max.	350 psi ± 25 psi 4 USgpm	350 psi $^{+5}_{-25}$ psi
PVE12*–*–**–C**VPD41	3000	Yes	900 psi Max.	600 psi ± 50 psi 4 USgpm	600 psi $^{+5}_{-25}$ psi
PVE19*–*–**–CV–10 PVE21*–*–**–CV–10 PVE19*–*–**–CVP–12 PVE21*–*–**–CVP–12	N/A N/A 3000 2700	Yes	250 psi Max.	160 psi ± 20 psi 6.5 USgpm	160 psi $^{+20}_{-30}$ psi
PVE19*–*–**–CVPC–12 PVE21*–*–**–CVPC–12	3000 2700	Yes	550 psi Max.	350 psi ± 25 psi 6.5 USgpm	360 psi $^{+20}_{-30}$ psi

Table 9. Load sensing compensator adjustment range.

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Overhaul Manual

Variable Inline Piston Pumps

PVE19(G)-***-*-20-C(***)-1*
PVE21(G)-***-*-20-C(***)-1*

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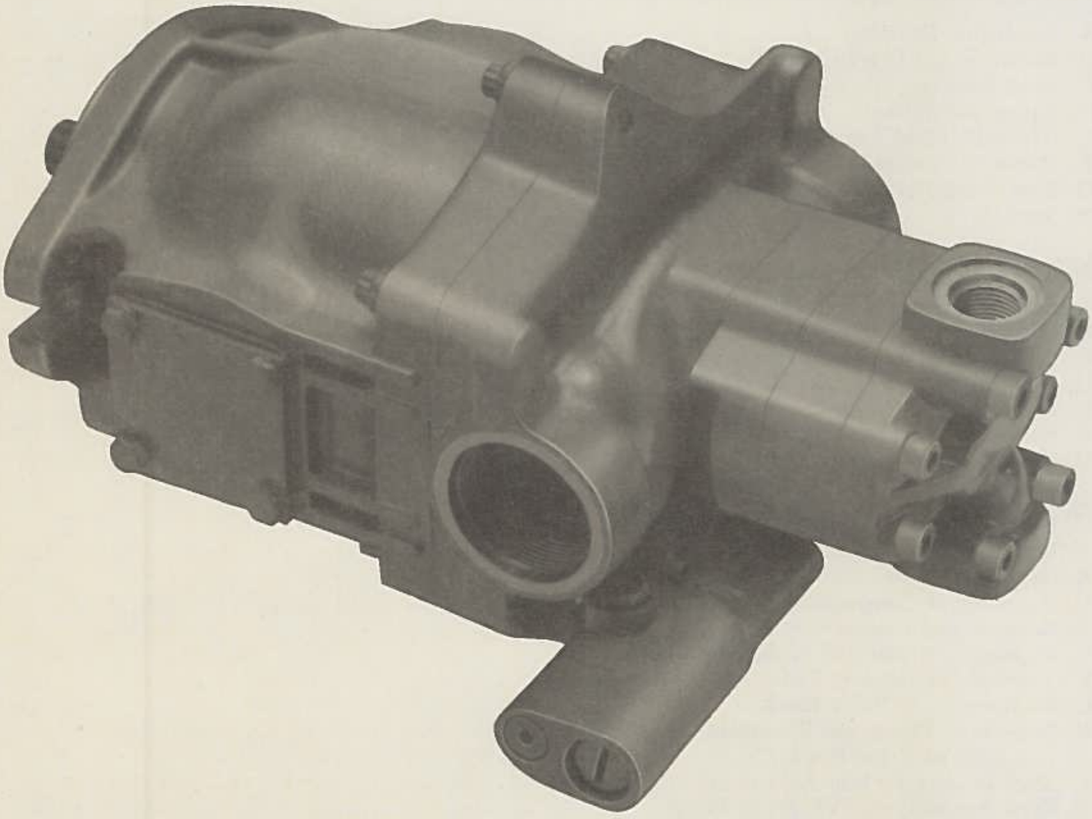

Vickers, Incorporated

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MODEL CODE BREAKDOWN

PVE ** (*)-(6)(F)R-*-20-C(**)-1*

- PUMP
- V - VARIABLE DISPLACEMENT
- INLINE PISTON UNIT E-SERIES
- FLOW RATING @ 1800 RPM
  - 10-10 USGPM
  - 19-19 USGPM
  - 21-21 USGPM
- AUX. GEAR PUMP G5 SERIES (OMIT FOR INDUSTRIAL MODELS)
- GEAR PUMP' FLOW RATE @1800 RPM 6 - 6 USGPM (OMIT FOR INDUSTRIAL MODELS)
- MOUNTING
  - F- FOOT MOUNTED (OMIT FOR FLANGE)
- SHAFT ROTATION (VIEWED FROM SHAFT END)
  - R-RIGHT HAND (CLOCKWISE)
  - L-LEFT HAND (C'CLOCKWISE)
- INPUT SHAFT
  - 1-SAE STRAIGHT KEYED
  - 2-SAE B-B 15 TOOTH SPLINE
- PUMP DESIGN
- CONTROL TYPE
  - C-10 PRESSURE COMPENSATOR 300-3000 PSI (PVE19) 300-2700 PSI (PVE21)
  - CV-10 LOAD SENSING
  - CVP-12 LOAD SENSING WITH PRESSURE LIMITER CONTROL DIFFERENTIAL 160 PSI STD
  - CVPC-12 LOAD SENSING WITH PRESSURE LIMITER CONTROL DIFFERENTIAL 350 PSI STD
  - CG-10 REMOTE CONTROL
- CONTROL DESIGN

Table 1. Model Code Breakdown

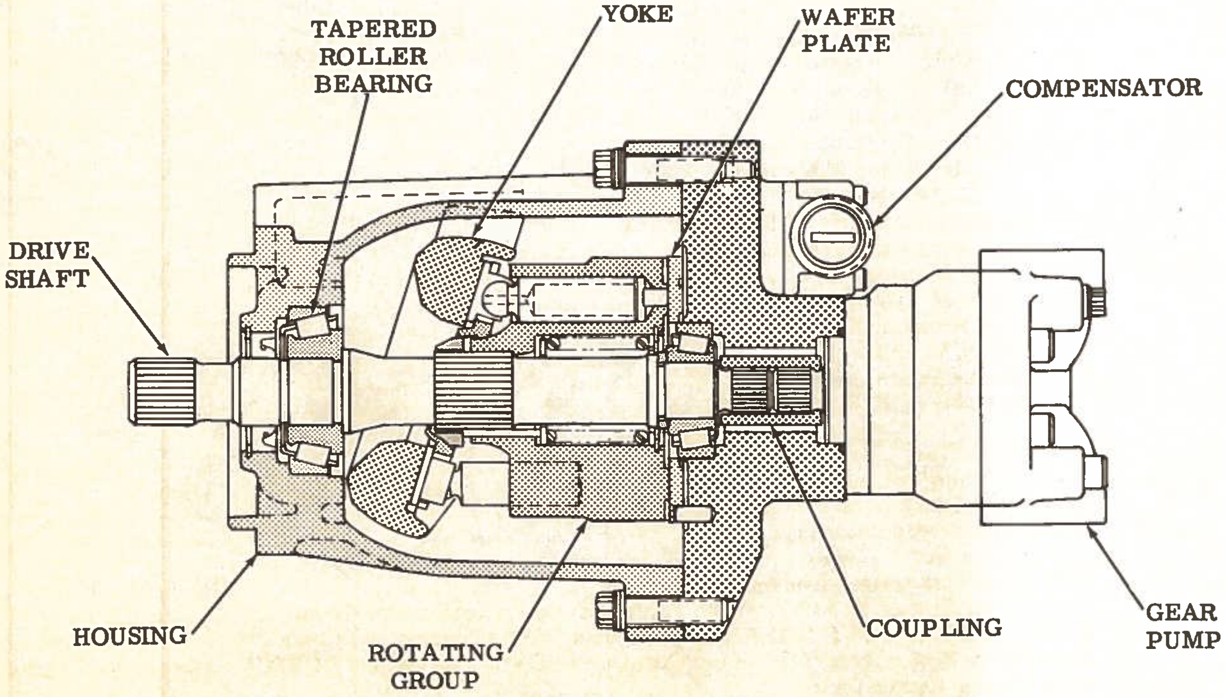


Figure 1. Sectional View of PVE19G

Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes operational characteristics and overhaul information for the PVE19(*) and the PVE21(*)-** variable volume piston pumps. The information contained herein pertains to the latest design series as listed in Table 1.

B. GENERAL INFORMATION

1. Related Publications – Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 2 are available from any Vickers application engineering office or from:

Vickers, Incorporated
Technical Publications
1401 Crooks Road
Troy, Michigan 48084

2. Model Codes – Variations within each basic model series are covered in the model code. Table 1 is a complete breakdown of the codes covering these units. Service inquiries should always include the complete unit model code number as stamped on the mounting flange.

MODEL SERIES	PARTS DRAWING	INSTALLATION DRAWING
PVE19	M-2841-S	322C
PVE21		
PVE19G5	M-2823-S	627526
PVE21G15		

Table 2

Section II – DESCRIPTION

A. GENERAL

Assembly of a typical pump package is shown in Figure 1.

Five types of compensator subassemblies are used with the PVE series pumps. Refer to Section III for principles of operation.

1. Compensator (C), (Flat Cut-Off Type): A pump using this compensator will maintain a constant load pressure for all values of flow within the capacity of the pump.

2. Compensator (CG), (Remote Control Type): This compensator is similar to the 'C' type compensator except the compensator is controlled by a remote hydraulic source such as a Vickers C175 relief valve.

3. Compensator (CV), (Load Sensing Type): A load sensing compensator provides flow at a pressure equal to that required by the load plus a constant value used as a pressure drop across a metering valve. The pump will change its flow with changes in size of the metering valve orifice. The pump and compensator together provide a constant flow source for the load, at a pressure established by the requirements of the load, hence the title "Load Sensing".

CAUTION
A relief valve must be provided in the external circuit to prevent excessive pressure build up at the pump.

4. Compensator (CVP), (Load Sensing Pressure Limiting Type): The CVP control is a combination of the standard flat cut-off compensator (C) and the load sensing compensator (CV). The load sensing compensator controls flow to the load across an external valve orifice. If pressure build-up exceeds the flat cut-off compensator setting, the flat cut-off compensator overrides the load sensing compensator and lowers the flow to prevent excessive pressure build-up at the pump.

5. Compensator (CVPC), (Load Sensing, Pressure Limiting Type): This compensator is the same as the "CVP" compenstor except the load sensing spring is heavier. The heavier spring provides a slightly higher pressure differential (160 △P vs. 350 △P) across the external valve orifice. See Figure 5.

B. APPLICATION

Pump ratings in USGPM as shown in the model coding are at 1800 RPM. For ratings at other speeds, methods of installation and other application information, Vickers sales engineering personnel should be consulted.

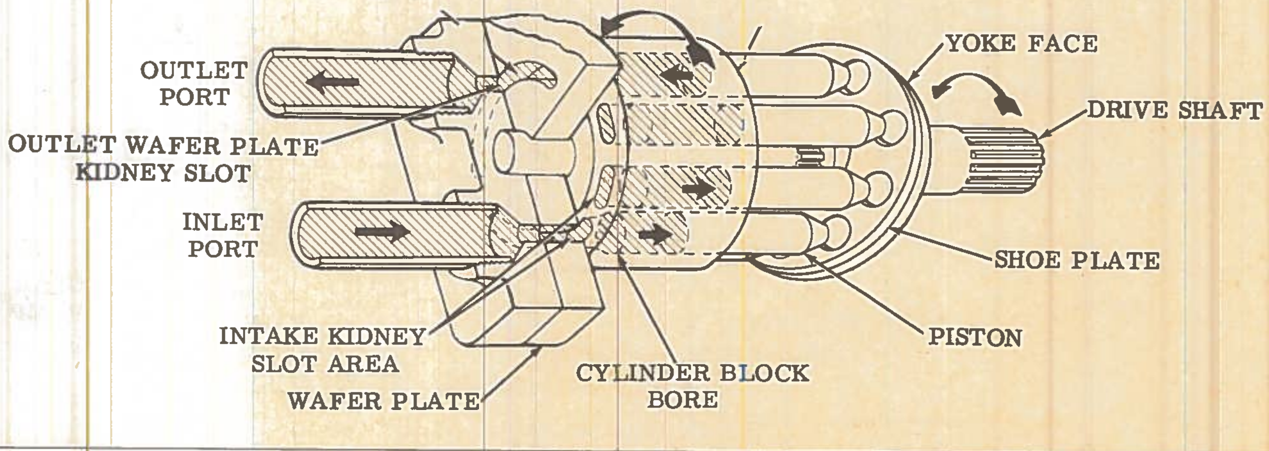


Figure 2

A. PISTON PUMP

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate. See Figure 2. The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted wafer plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

B. COMPENSATOR (Flat Cut-Off Type - "C")

A flat cut-off compensated pump will maintain a constant load pressure for all values of flow within the capacity of the pump providing the load is sufficient to build up pressure.

A step by step description of the flat cut-off type compensator control follows. Refer to Figure 3 throughout this discussion.

When a no load condition exists, the pump will deliver maximum flow at zero pressure. As the actuator load increases, pressure will rise; however, flow will remain at maximum until pressure reaches the compensator spring setting (cracking pressure). As a further increase in load occurs, system pressure will cause the compensator spool to move against the compensator spring, metering flow to the yoke stroking piston. The yoke stroking piston then moves the yoke to reduce flow. As flow is reduced, system pressure reduces slightly causing the compensator spool to return to the null position. At null, flow to the yoke stroking piston stops; movement of the yoke will stop and the flow will stabilize at a reduce value. If the load were to continue to increase, the pump flow will reduce to zero (0) and a deadhead pressure condition would exist. The pressure differential needed to cause the compensator spool to change from maximum flow (cracking pressure) to zero flow (deadhead pressure) is approximately 50 to 150 PSI.

Pump outlet flow is proportional to the control range from cracking pressure to deadhead pressure. (i.e. If cracking pressure is 2900 PSI (max. flow) and deadhead pressure is 3000 PSI (min. flow), a pressure of 2950 PSI would be equal to ½ maximum flow.)

If the load decreases, pressure will decrease proportionally and the compensator spring will move the spool down, opening the yoke stroking piston to case drain. As fluid is metered from the yoke stroking piston, the yoke spring will stroke the yoke to increase flow. The increase in flow causes a proportional increase in system pressure. The increase in system pressure returns the compensator spool to a null position and flow from the yoke stroking position will stop; simultaneously, movement of the yoke will stop. The flow will stay constant until another change of load occurs.

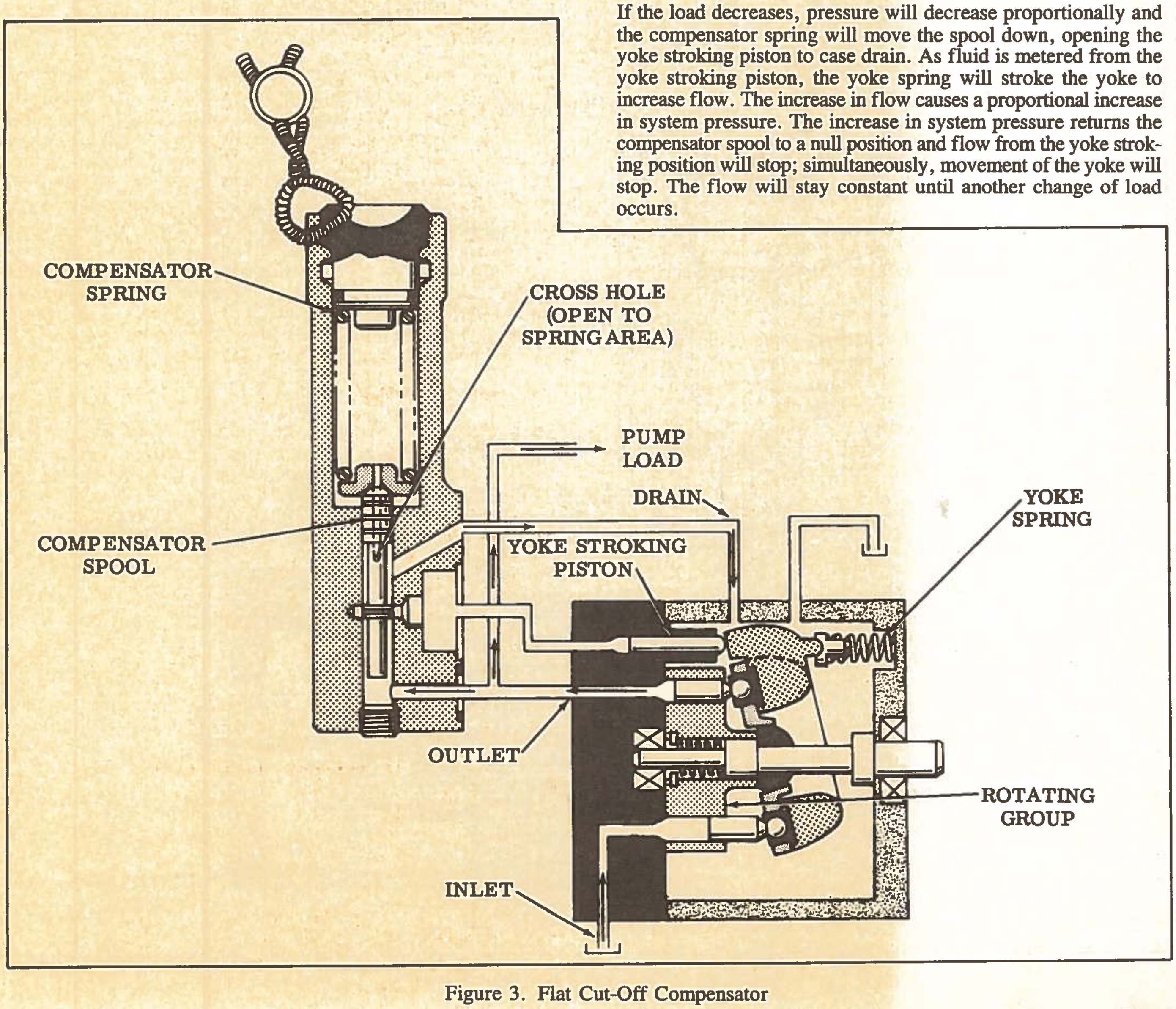


Figure 3. Flat Cut-Off Compensator

If the load continues to decrease, pump flow will continue to increase, holding the outlet at compensator cracking pressure. When maximum flow is reached (max. stroke), a maximum flow and a maximum pressure condition exists. A further decrease in load will lower the outlet pressure until a final theoretical condition of maximum flow and zero pressure is obtained.

C. **COMPENSATOR** (Remote Control - "CG")

This compensator allows the operator to change the pressure setting through the use of a remote control valve. The "CG" compensator has the same performance characteristics as the "C" type compenstor.

D. **COMPENSATOR** (Load Sensing Type - "CV")

APPLICATION.

A frequent application of pressure compensator pumps is to supply sevo valves or mechanically operated metering valves, whose function is to control flow to a hydraulic actuator (cylinder or motor).

In such circuits it is often desirable that flow be proportional only to an external valve spool position. This requires a constant pressure drop across the external valve. (NOTE: Flow through a valve varies with pressure drop as well as with valve spool position.)

Pumps incorporating the load sensing feature have a constant flow characteristic: Flow is constant regardless of the load pressure.

CAUTION

A relief valve must be used to prevent outlet pressure from exceeding pump ratings if the load is excessive.

MINIMUM PUMP PRESSURE.

The minimum outlet pressure developed by the pump (no load) is a function of the compensator spring force versus the yoke spring force, whichever is greater. (Please note that external valve spool position (orifice size), has nothing to do with the minimum outlet pressure of the pump). The orifice size controls pump rate of flow only. The minimum outlet pressure will be constant for all settings of the valve spool orifice and is considered the pressure drop across the orifice (△P).

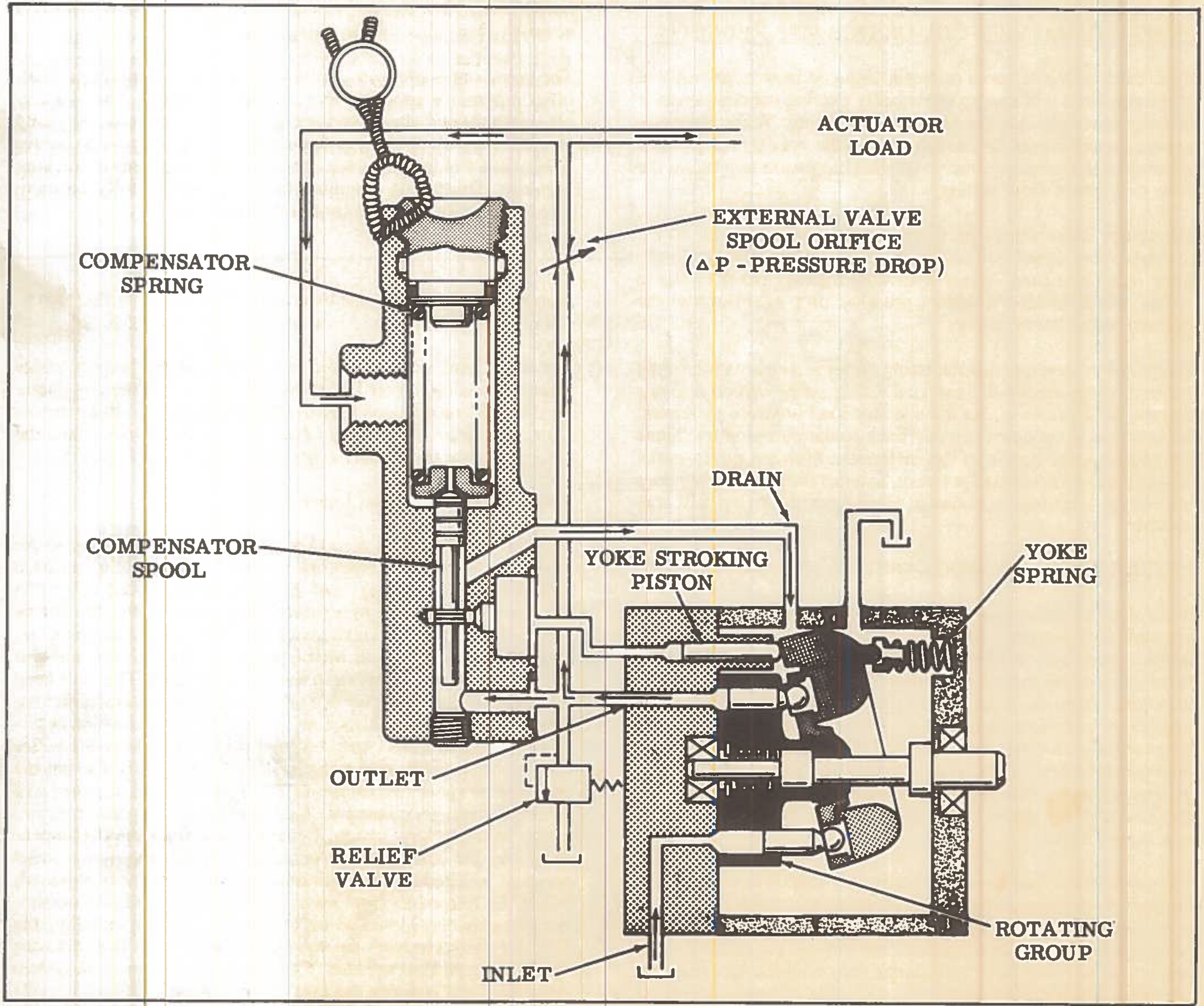


Figure 4. Load Sensing Compensator (CV)

CIRCUIT OPERATION AT MINIMUM PRESSURE.

Refer to Figure 4 during the following description. Assume a no load condition.

The pump load consists of the pressure drop accross the valve spool orifice (△P), plus the pressure developed by the work being performed at the actuator. (In this case the actuator is unloaded and only the pressure drop across the valve spool orifice (△P) will be considered.)

Flow is restricted through the valve spool orifice and develops a pressure at the outlet of the pump. This pressure is applied to the lower end of the compensator spool. Initially, the compensator spring is holding the spool in the down position and the yoke is at maximum delivery position. When the pump is started, the increasing flow increases pressure at the lower end of the compensator spool and the compensator spool opens pressure to the yoke stroking piston. The yoke then strokes to a lower flow, lowering the pressure drop across the external valve orifice. When pressure reaches △P, the compensator spool will null. At this time, the stroking piston will remain stable until the external valve spool orifice is changed. (See Figure 4.)

EXTERNAL VALVE SPOOL ORIFICE SIZE REDUCED.

If the external valve spool orifice is reduced in size, pressure at the pump outlet will rise proportionally causing the compensator spool to move against the compensator spring. When the compensator spool moves far enough to open the yoke stroking piston to pump outlet pressure, the yoke stroking piston will move the yoke to a lower flow setting.

The compensator senses pressure at the downstream side of the external valve spool orifice and compares this pressure to the pump outlet pressure. The compensator then adjusts the yoke to a flow which holds a constant pressure drop (△P) across the external valve spool orifice.

The pressure developed at the pump outlet is a summation of the pressure drop across the external valve spool orifice and the actuator load pressure. As the actuator load pressure increases, the increase is reflected directly back to the pump outlet. Since the compensator monitors the difference between pump outlet pressure and actuator load pressure, and this difference (△P) does not change with load variations, flow from the pump will stay constant.

EXTERNAL VALVE SPOOL ORIFICE SIZE INCREASED.

If the external valve spool orifice size is increased, pump outlet pressure will decrease, lowering force against the compensator spool. (See Figure 4.) The compensator spring causes the spool to move, opening the yoke stroking piston to case drain. As fluid is metered from the yoke stroking piston, the yoke spring force strokes the yoke to a higher flow. The increase in flow through the external valve spool orifice establishes once again the constant pressure drop (△P). With differential pressure (△P) across the external valve orifice, the compenstor spool nulls. Flow from the yoke stroking piston stops, and the pump flow rate stabilizes at a higher value.

Operation of the load sensing compensator is such that as the load pressure varies, the pump outlet pressure will follow the variations, holding a constant pressure drop (△P) across the external valve spool orifice, and a constant flow through the external valve and actuator. Pump flow will change only with changes in external valve spool orifice size.

E. **COMPENATOR** (Load Sensing with Pressure Limiting - "CVP" or "CVPC")

As you would expect from the title, the CVP or CVPC control is a combination of both the features of the flat cut-off and load sensing compensators.

The load sensing portion functions at pressures below the flat cut-off compensator setting and provides a constant flow characteristic. If pressure exceeds the flat cut-off compensator setting, the yoke will stroke to zero flow at maximum pressure lowering the horsepower requirements for holding circuits and protecting the pump. Refer to Figure 5 throughout the following circuit explanation.

Assume an actuator load that is increasing gradually. Also, assume the pump outlet pressure is lower than the flat cut-off compensator cracking pressure. As actuator load pressure increases, the load sensing compensator spool senses the difference between pump outlet pressure and actuator load pressure. As long as the difference between the pump outlet pressure and the actuator load pressure (△P) is constant, flow to the load will stay constant. As pressure rises across the load, leakage will increase in the pump and load. The load sensing portion of the compensator adjusts pump outlet flow to compensate for leakage while providing a constant flow through the valve spool orifice.

The pump outlet pressure continues to increase until the flat cut-off compensator spool reaches cracking pressure. The flat cut-off compensator spool then meters flow to the yoke stroking piston. The yoke stroking piston starts moving the yoke to reduce flow while holding the outlet pressure at compensator cracking pressure. This action continues until the pump is fully compensated (zero flow and maximum pressure).

STANDBY OPERATION FEATURE.

Standby defined: When the external valve spool is shifted to zero flow, the circuit is placed in standby (See Figure 5.).

The small fixed orifice located in the compensator body provides a decompression feature for the load circuit during standby operation. The decompression feature allows the pump to stroke to zero flow and minimum pressure (△P), if the load is blocked and the external valve spool orifice is closed. (Refer to Figure 5.)

The circuit functions as follows:

Assume the pump is at zero flow with maximum pressure to the load. The flat cut-off compenstor spool will be in the up position (compressing the spring) and the load sensing spool will be in the down position due to actuator load pressure plus the spring force. If the external valve spool orifice is closed at this time, fluid under pressure will be trapped in the load circuit and will hold the load sensing spool in the down position. This will keep the pump outlet pressure at flat cut-off compensator cracking pressure (a power loss since no work is being performed at this time). To prevent this condition from continuing, the small orifice meters the fluid trapped in the load back through the flat cut-off compenstor spool to case drain. The actuator load pressure will decrease gradually causing the load sensing spool to open pressure to the yoke stroking piston, bypassing the flat cut-off compensator. As the actuator load pressure reduces, the pump outlet pressure will reduce until minimum pump pressure is obtained. When the minimum flow/minimum pressure condition occurs, the pump is considered to be in standby. During standby, the CVP(C) control reduces the input power well below that of a standard "C" type compensator. This provides an increase in system efficiency and reduces the cost of operation.

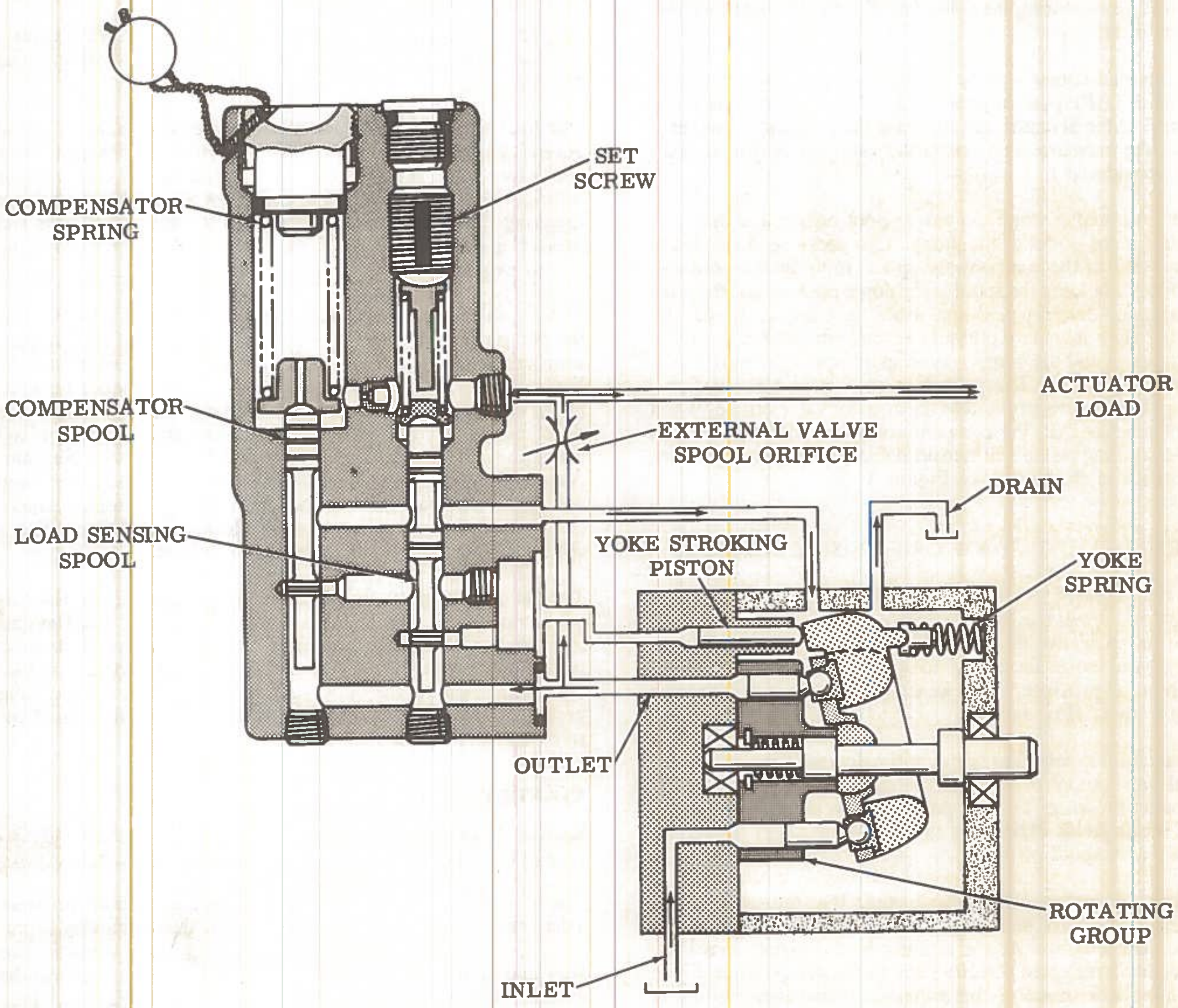


Figure 5. Load Sensing Pressure Limiting Compensator (CVP or CVPC)

Section IV – INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawings listed in Table 2 will show installation dimensions and port locations.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawing. (See Table 2.)

1. Direct Mounting - A pilot on the pump mounting flange (Figure 6) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without Vickers sales engineering approval.

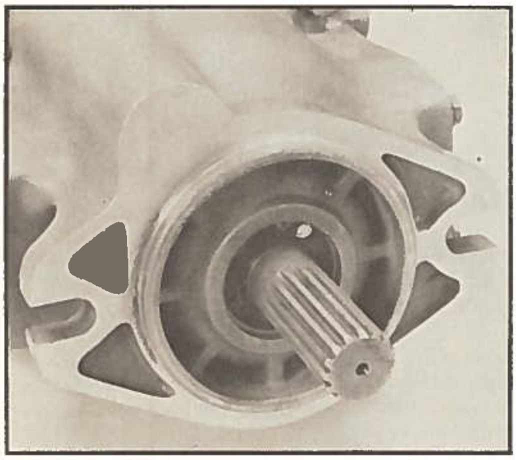


Figure 6. Pump Pilot Flange

C. SHAFT ROTATION

Pumps are normally assembled for right-hand (clockwise) rotation as viewed from the shaft end. A pump made for left-hand rotation is identified by an "L" in the model code (See Table 1).

CAUTION
Never drive a pump in the wrong direction of rotation. Seizure may result necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing and pickling.

NOTE
For instructions on pickling, refer to instruction sheet 1221-S

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulance and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet M-2950-S for oil selection is available from Vickers, Incorporated, Technical Publications, Troy, Michigan 48084. Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, see your Vickers representative.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of oil filters, breathers, reservoirs, etc. cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design to insure that aeration of the oil is kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in hydraulic systems are:

1. Very high viscosities at start-up temperatures can cause noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Relief valves limit pressure in the system to a prescribed maximum and protect components from excessive pressure. The setting of the relief valve depends on the work requirements of the system components.

G. GEAR PUMP PORT POSITIONS

The gear pump is assembled to the piston pump with its pressure port toward the compensator. Right and left hand compensator positions are also shown in Figure 7.

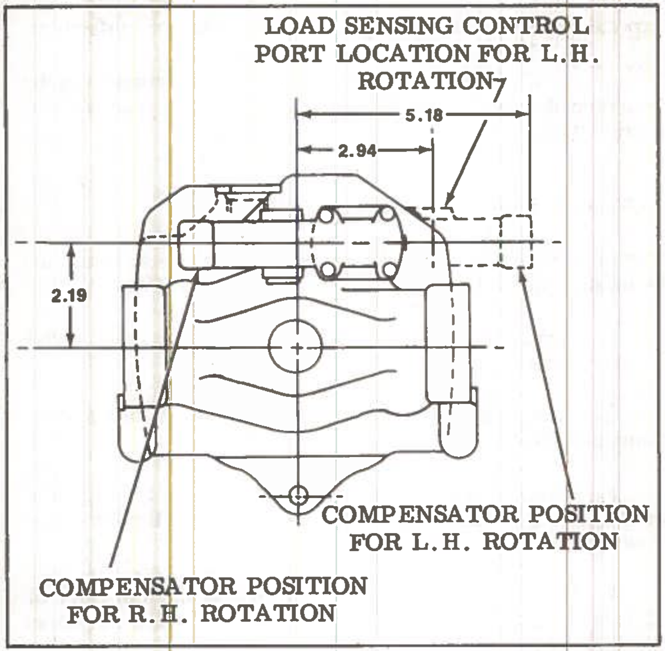

LOAD SENSING CONTROL PORT LOCATION FOR L.H. ROTATION
5.18
2.94
2.19
COMPENSATOR POSITION FOR L.H. ROTATION
COMPENSATOR POSITION FOR R.H. ROTATION

Figure 7. C/CV/CVP Compensator Positions For Right and Left Hand Shaft Rotation

H. START-UP

With a minimum drive speed of 650 RPM, a pump should prime almost immediately if provision is made to initially purge the air from the system.

Failure to prime within a reasonable length of time may result in damage due to lack of lubrication. Inlet lines must be tight and free from air leaks. However, it may be necessary to crack a fitting on the outlet side of the pump to purge trapped air.

Section V – SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following tools for overhauling the piston pump are shown in Figure 8.

1. Torque wrench with short extension and sockets.
2. 1″ micrometer.
3. 1″ depth micrometer.
4. External Truarc pliers.
5. Internal Truarc pliers.

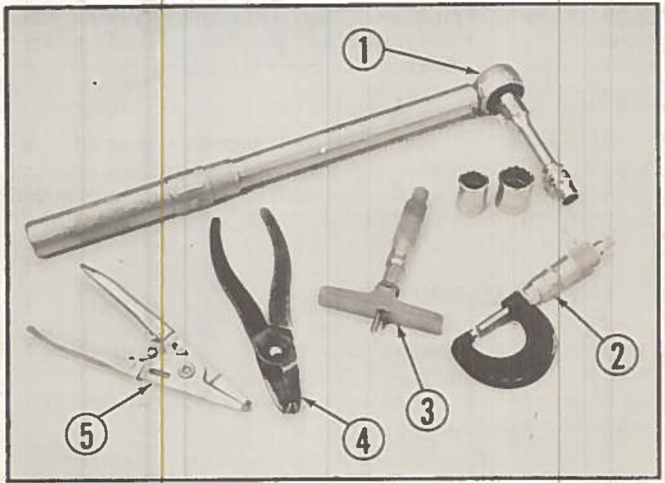
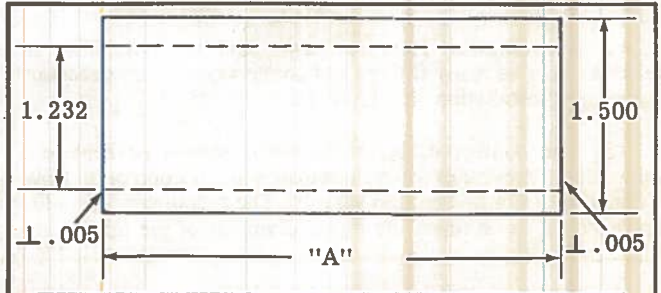


Figure 8. Standard Tools

In addition to the above tools, an arbor press is required to service bearings, etc. Maintenance of this unit is intricate and should not be attempted without the proper tools.

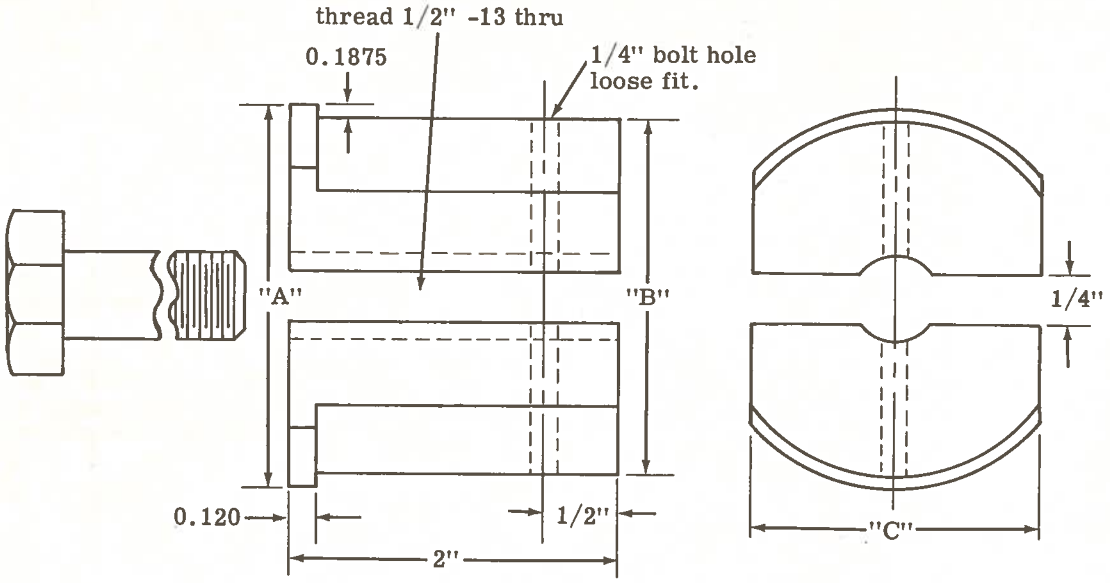
SPECIAL TOOLS

Special tools are shown in Figures 9, 10, 11 and 12.



USE FOR	"A"
Intermediate shaft bearing installation	4"
Drive shaft bearing installation	6"
Drive shaft bearing removal	9"
1 1/2" heavy wall tubing	

Figure 9. Special Shaft Bearing Removal and Installation Tools



Bearing Race Puller			
Description	A	B	C
Valve Block	1.675	1.300	1.250
Housing	2.125	1.625	1.500

Use a 5" long 1/2" -13 hex head screw with this tool.

Figure 10. Bearing Race Removal Tools

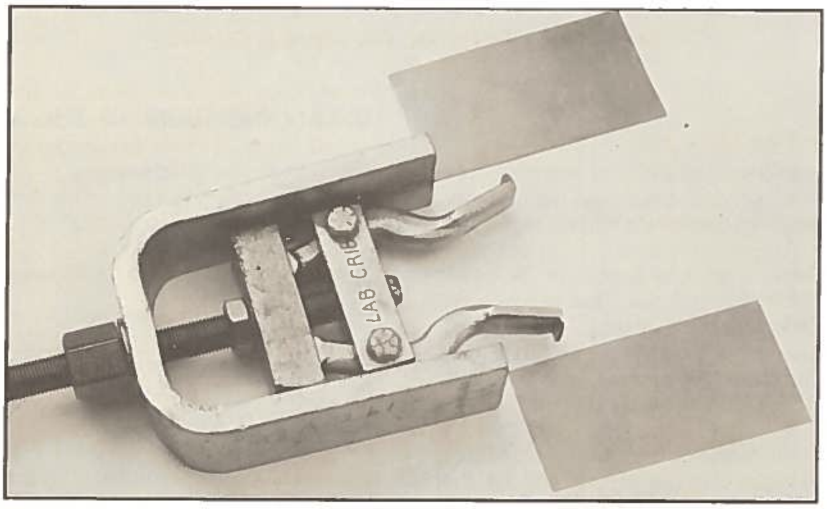
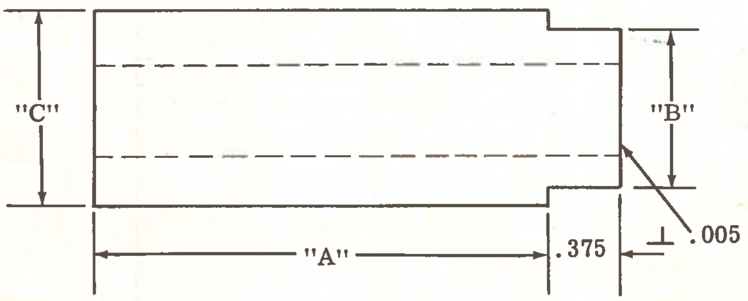


Figure 10a. Valve Block Bearing Race Removal Tool and Shim Stock



NOMINAL PIPE SIZE	"A"	"B"	"C"
1 1/2"	4"	1.625	1.900
2"	4"	2.125	2.375
SCHEDULE 80 (extra heavy)			

Figure 11. Special Bearing Race Installation Tools

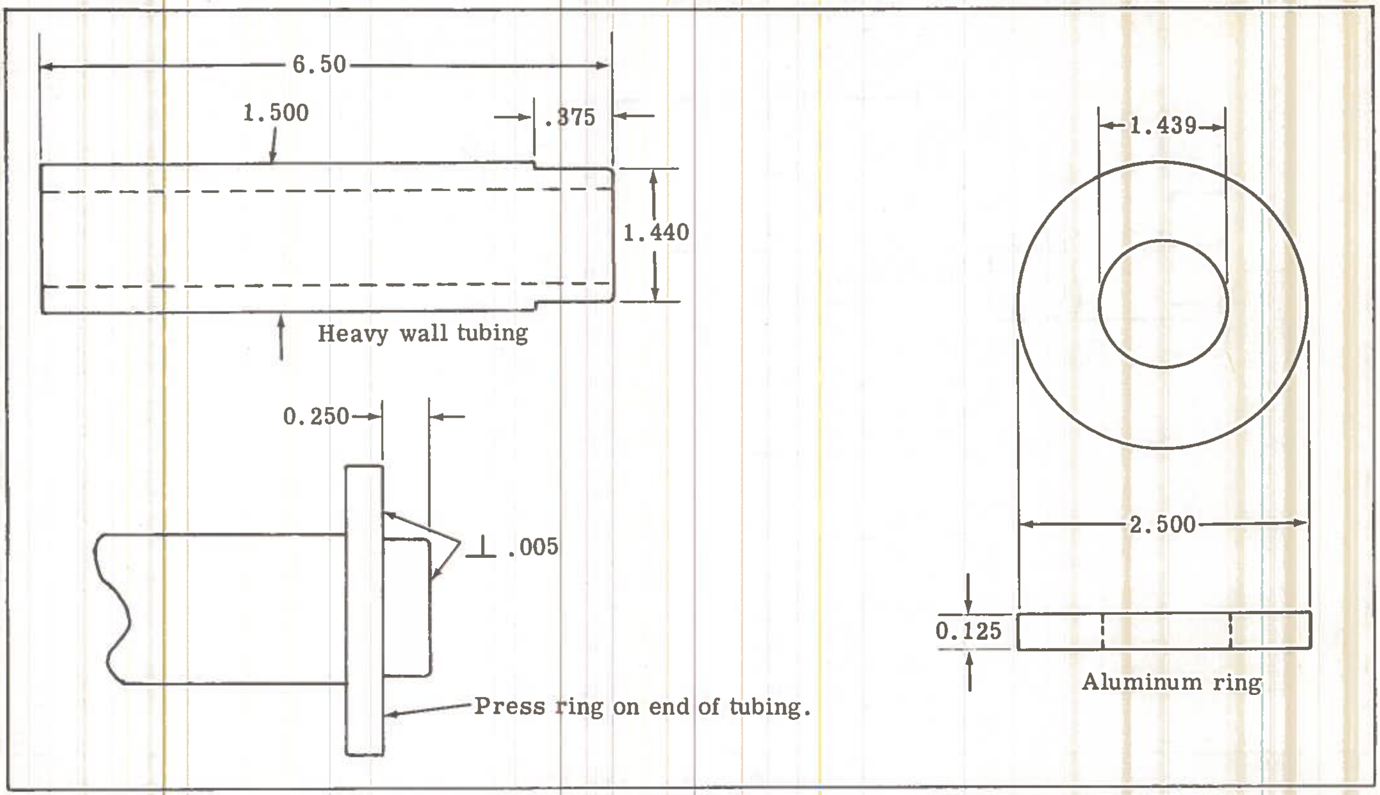


Figure 12. Shaft Seal Driver

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher than normal pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. (See Table 3.)

5. A pump which is running excessively hot or noisy is a potential filure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

F. REPLACEMENT PARTS

Reliable operation through the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and materials are used in the manufacture of our parts. Substitutions may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. TROUBLESHOOTING

Table 3 lists the common difficulties experienced with piston pumps and hydraulic systems. It also indicates probable causes and remedies for each of the troubles listed.

TROUBLE	CAUSE	REMEDY
I. Excessive pump noise.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended transmission fluid. DO NOT overfill.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream while system is under pressure.
	Vacuum condition.	1. Check inlet (suction lines and fittings for air leaks. 2. Check auxiliary pump function.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Pump overheating.	Internal leakage.	If established that excessive internal leakage exists, return vehicle to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief valve open. Compensator misadjusted.	Replace or repair.
	Loss of fluid internally (slippage).	Return vehicle to maintenance shop for repair of hydraulic system.
IV. Loss of fluid.	1. Ruptured hydraulic lines. 2. Loose fittings. 3. Leaking gaskets or seals in pump or circuit.	1. Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose. 2. Observe mating sections of pump for leaks. Replace seals or gaskets if possible.
V. Miscellaneous.	1. Sheared shaft key. 2. Disconnected or broken drive mechanisms.	Locate and repair.

Table 3. Troubleshooting Chart

GENERAL

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure.

After removing the pump from the system and before disassembly, cap or plug all ports and disconnected hydraulic lines. Clean the outside of the unit thoroughly to prevent entry of dirt into the system.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Periodic maintenance of the pump will generally not require disassembly to the extent described here. However, the sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figure 13. Special procedures are included in the following steps.

NOTE

Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

A. DISASSEMBLY

NOTE

Mark all body sections with a prick punch to provide correct reassembly.

1. GEAR PUMP REMOVAL (PVE**G Units Only).

a. Remove the two 12 point hex screws (1) that hold gear pump (2) to the valve plate (32). Pull gear pump from valve plate and coupling (3). Remove the coupling.

b. Remove "O" ring (4) from the pilot flange of the gear pump.

NOTE

DO NOT attempt repair of the gear pump. If a problem is apparent, replace the gear pump as a unit.

2. REMOVAL AND DISASSEMBLY OF THE COMPENSATOR S/A.

a. Remove four screws (5) that hold the compensator S/A to valve block (32) and pull the compensator away from the valve block.

b. Remove compensator gasket (6) and "O" ring (7) from body (15) of compensator S/A.

c. Remove lockwire (8), plug (9) and "O" ring (11) (10 and 11 on the CV compensator).

d. Remove spring (12), seat (13) and spool (14) from the compensator body (15) and set aside for inspection.

e. Do not remove plug(s) (29) unless it is necessary for inspection of the bore.

NOTE

The following steps concerns only the CVP and CVPC compensator S/A.

f. Unscrew plug (16) and remove parts (17) through (23).

g. Remove plug (24) to gain access to orifice plug (25). Remove orifice plug (25). Do not remove check valve S/A (26) from body (15).

h. Remove plug (27) and "O" ring (28).

i. Remove plug(s) (29) only if necessary to inspect the spool bore.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts, using a commercial solvent that is compatible with system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning spool, compensator body and valve block passages.

B. INSPECTION REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

1. Inspect all components for excessive wear, erosion and/or seizure.

2. Inspect plugs (8), (9), (16), (24), (25), (27) (28) and (29) for damaged threads, burrs, etc. Make sure orifice hole is open in plug (25). Replace if defective.

3. Inspect spring (12) ((12) and (21) for CVP (6) compensators) for wear and parallelism. Spring ends must be parallel. Replace if spring is warped or wear is evident.

4. Inspect seat (13) for wear in the area of spool contact.

5. Inspect spool (14) for excessive wear, galling, scratches, etc. If scratches exist across the spool land, replace the spool and inspect the body bore. Rotate the spool while moving in and out of the bore to check the binding. Binding cannot be tolerated. If binding is evident, use an India stone to break the sharp edges of the balancing grooves. Use 500 grit paper lightly on the outer surface of the spool. Clean in solvent and lubricate, then try the bind test again. If binding still persists, replace the spool and/or body.

6. Inspect the screws for damaged threads. Replace all damaged threads. Replace all damaged screws.

NOTE

The following step pertains to the CVP or CVPC compensator S/A.

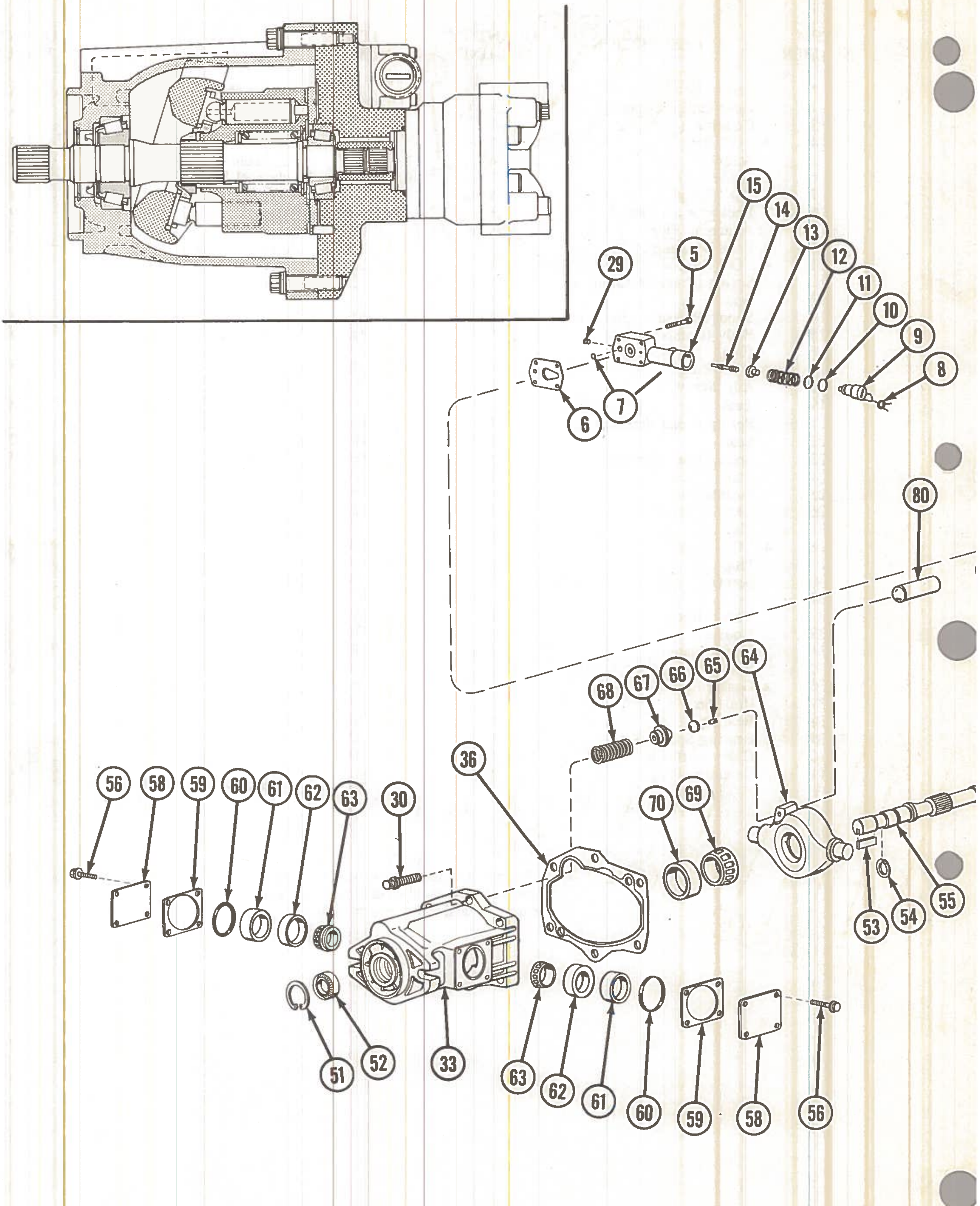
7. Inspect the load sensing section of the CVP compensator as follows:

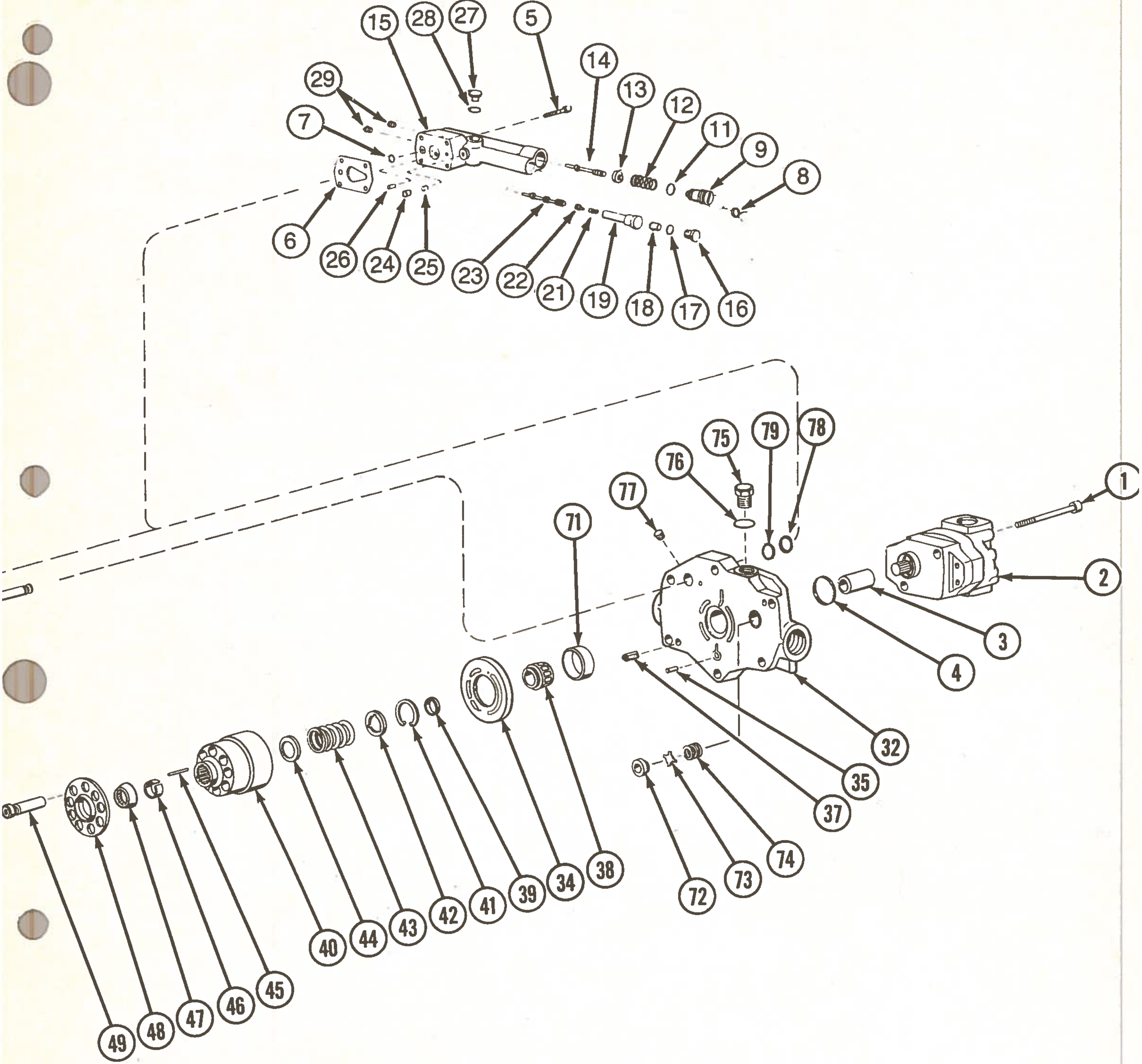
a. Inspect the load sensing section of the CVP compensator if wear is evident. Clean up burrs with an India stone.

ITEM NUMBER	DESCRIPTION	QUANTITY PER UNIT	ITEM NUMBER	DESCRIPTION	QUANTITY PER UNIT
1	Screw	2	42	Washer (Notched)	1
2	Gear Pump Assembly	1	43	Spring	1
3	Coupling	1	44	Washer (Pin)	1
4	▲ "O" Ring	1	45	Pin	3
5	Screw	4	46	Pin Retainer	1
6	▲ Gasket	1	47	Spherical Washer	1
7	▲ "O" Ring	1	48	Shoe Plate	1
8	Lockwire and Seal	1	49	Piston & Shoe Subassembly	9
9	Adjusting Plug	1	50	—	-
10	▲ Back-Up Ring	1	51	Retaining Ring	1
11	▲ "O" Ring	1	52	Shaft Seal	1
12	Spring (Pressure Limiter)	1	53	Shaft Key	1
13	Seat	1	54	Retaining Ring	1
14	Spool (Pressure Limiter)	1	55	Shaft	1
15	Body (Compensator)	1	56	Screw	4
16	Plug	1	57	—	-
17	▲ "O" Ring	1	58	Pintle Cover	2
18	Adj. Screw	1	59	Shims (Kit)	1
19	Seat	1	60	▲ "O" Ring	2
21	Spring (Load Sensing)	1	61	Bearing Spacer	2
22	Seat	1	62	Bearing Race	2
23	Spool (Load Sensing)	1	63	Bearing	2
24	Plug	1	64	Yoke	1
25	Orifice Plug	1	65	Roll Pin	1
26	Check Valve S/A	1	66	Seat	1
27	Plug	1	67	Seat	1
28	▲ "O" Ring	1	68	Spring	1
29	Plug	2	69	Bearing (Shaft)	1
30	Screw	6	70	Bearing Race	1
31	—	-	71	Bearing Race	1
32	Valve Block	1	72	Seat (Check Valve)	1
33	Housing	1	73	Check Valve	1
34	Wafer Plate	1	74	Spring (Check Valve)	1
35	Pin	1	75	Plug	1
36	▲ Gasket	1	76	▲ "O" Ring	1
37	Roll Pin	2	77	Plug	1
38	Bearing	1	78	▲ "O" Ring	1
39	Bearing Spacer Kit	1	79	Snap Ring	1
40	Cylinder Block	1	80	Piston	1
41	Retaining Ring	1	81	—	-
			82	Rod Piston	1

NOTE

▲ Indicated parts included in seal kit. Refer to parts drawing tabulted in Figure 2 for seal kit number and parts information.





b. If wear is evident, replace the part. Note: If spool (23), seat (22), spring (21), seat (19), adj. screw (18) or body (15) are replaced, the compensator must be readjusted to the correct pressure. Refer to the test procedure Section VII for instructions on compensator adjustment.

c. Check seat (22) and spool (23) for wear. Refer to step B.5 for procedure when checking the pressure limiting spool.

d. Inspect body S/A (15) bores for scratches. Make sure the orifice plug (25) opening is clear.

C. ASSEMBLY OF COMPENSATOR

Replace the gaskets and "O" rings removed from the unit with those supplied in the seal kit. DO NOT use grease to hold the seals in place. Use a viscosity improver (STP or equivalent). Flood all parts with system fluid to provide initial lubrication and prevent seizure. Assembly of the parts will be in the reverse numerical sequence. Special procedures are included in the following steps.

NOTE
The following step refers to the CVP or CVPC compensator only.

1. Install parts (29) through (27) into body (15).

a. Install parts (25), (24) and spool (23). Make certain the spool does not bind or hang up in the body bore.

b. Assemble parts (22) through (19) together. Insert the assembled parts (seat first) into compensator body (15). Assemble with spool bores in vertical position to prevent seat from falling into cross port. Visually observe proper assembly through load sensing port. The seat must rest against compensator spool (23) at completion of assembly.

c. Thread adj. screw (18) into body (15) bore until top of adj. screw is .065 below body (15) surface.

d. Install "O" ring (17) over plug (16) and thread plug (16) into compensator body (15).

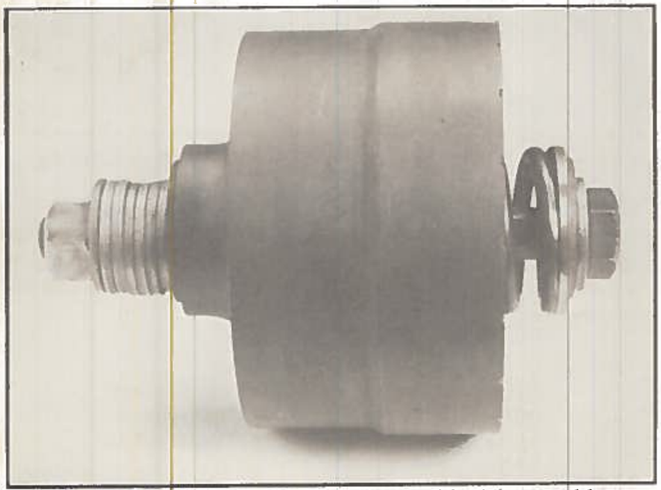


Figure 14. Cylinder Block Subassembly Disassembly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

2. Install plug (29) into the "C" and "CV" compensator bodies. Plugs were installed into the "CVP" compensator body during the preceding step.

3. Install parts (14) through (7) into compensator body (15). Make certain the spool (14) does not bind within the bore. Refer to procedure established in step B.5 for further information. Lockwire and seal (8) will be installed during test procedure section VII.

4. Install gasket (6) in place on the face of compensator body (15). Cover the compensator body with clean Kraft paper and set aside for final assembly of the pump.

D. REMOVAL AND DISASSEMBLY OF ROTATING GROUP

1. Remove the six screws (3) which hold pump housing (33) to valve block (32).

2. Pull valve block (32) away from housing (33) then discard gasket (36).

3. Remove wafer plate (34) and pin (35) from the valve block and set aside for inspection.

4. Remove bearing (38) and bearing spacer (39) from the end of drive shaft (55).

5. Slide the rotating group from the pump housing. (Hold the shoe plate with both hands during removal to prevent the group from separating.)

NOTE
The rotating group consists of a cylinder block S/A (40), nine piston and shoe subassemblies (49), the shoe plate (48), a spherical washer (47), three pins (45) and a pin retainer (46).

CAUTION
The spring located within the cylinder block S/A is under a high tension and can cause bodily harm if the retaining ring is removed. See Figure 14 for disassembly instructions.

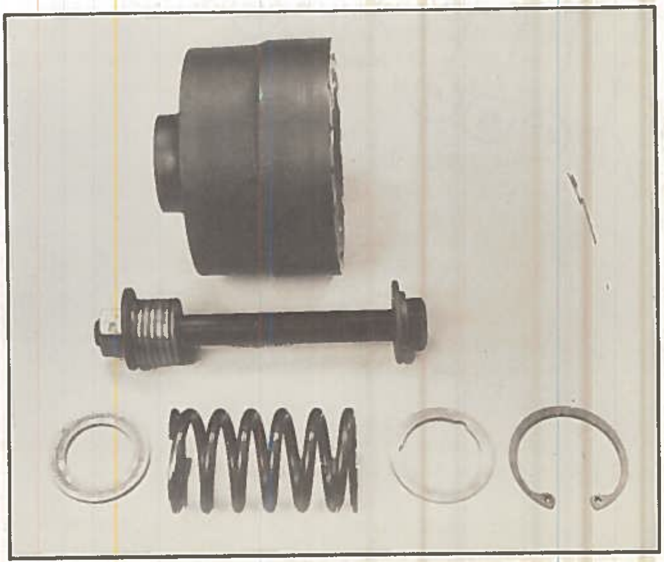


Figure 14a. Cylinder block subassembly parts.

6. Separate the rotating group components and set aside for inspection. Use care when handling these close tolerance parts to prevent burrs from forming.

E. INSPECTION REPAIR AND REPLACEMENT

1. Check bearing (38) for scoring or brinelling of the rollers.

2. Check bearing spacer (39) for burrs.

3. Inspect cylinder block S/A face (40) for wear, scratches and/or erosion between cylinders. Check the spring, washers and retaining ring located within the cylinder block S/A.

4. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (49) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston, lubricate with clean hydraulic fluid and try again. Even minor contamination of the fluid could cause the piston to freeze up in the cylinder bore.

5. Inspect each piston and shoe subassembly (49) for a maximum end play of 0.005 inch between the piston and shoe.

6. The face thickness dimension of each shoe must be within 0.001 inch of each other.

7. Inspect shoe plate (48) for excessive wear and cracking in the area of spherical washer (47). If heavy wear or cracks are found, replace the shoe plate and spherical washer at the same time.

8. Check spherical washer (47) for burrs, wear and possible scratches due to pin (45) breakage. Replace if wear is excessive.

9. Inspect pins (45) for equal length, excessive wear and possible bending. Replace all pins simultaneously if one is defective.

10. The pin retainer (46) may develop burrs. Remove all burrs with an India stone.

11. Inspect the face of wafer plate (34) for excessive wear, scratches and possible fracture. If the wafer plate is fractured, make sure the new plate rests flat against the valve block at assembly and that wafer plate pin (35) does not extend too far and hold the wafer plate away from the valve block.

NOTE

Inspect the yoke face and shaft bearing as follows: If either are defective, perform step E.14 and remove the yoke from the housing. If the drive shaft is defective, follow procedure shown in step E.17 to remove the drive shaft from the front bearing. If the drive shaft, shaft bearing, housing or valve block are replaced, a shaft bearing preload adjustment must be performed. See Section VI.J.

12. Inspect pump drive shaft (55) for wear, chipped splines and burrs; remove burrs with an India stone.

13. Inspect shaft bearing (69) for brinelling, pitting of the rollers and roughness when turned in race (70) located in the housing. If the bearing is defective, both the bearing and the race must be replaced. If the bearing shows no evidence of wear, do not remove the bearing race from the housing or the bearing from the shaft. If the bearing requires removal, perform the following steps 14 through 18.

14. Inspect yoke (64) face for wear, roughness or scoring.

a. Remove the four screws (56) that hold pintle covers (58) on each side of the housing. Remove the pintle covers. Be careful not to damage the shims which lie directly under the covers.

b. Retain shims (59), if possible, and use a micrometer to measure the total shim thickness. If the bearings are not defective, the same shims or a new shim of the same thickness will be needed to preload the bearings at installation. Remove "O" rings (60) and bearing spacers (61) from each pintle.

NOTE

If shims (59) were destroyed during disassembly, a yoke bearing preload adjustment must be made at assembly.

c. Slide the yoke from side to side to loosen the yoke bearing races (62) within the housing. The races are a normal slip fit but may be tight. Use an open end wrench between the yoke and the pintle bearing to help slide out the races. Apply pressure to bearing (63) at the approximate center and allow the bearing rollers to gently press the race out of the housing.

15. Remove yoke (64) and drive shaft (55) from the housing together. Turn the yoke at an angle and slide the two parts out of the housing. See Figure 15.

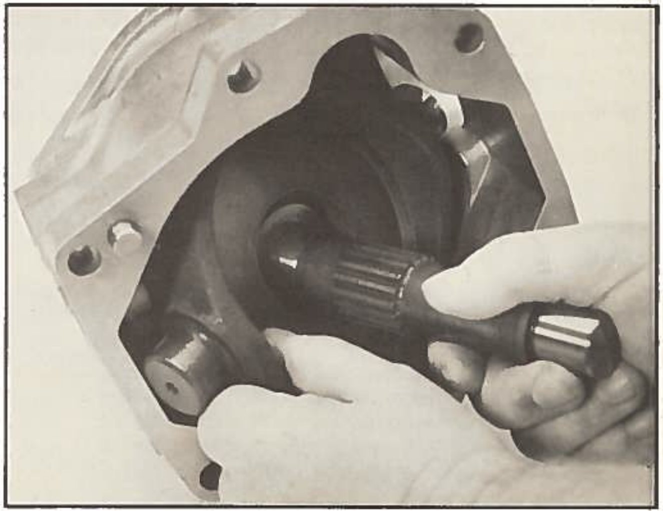


Figure 15. Removal of Yoke and Shaft From Housing.

16. After removal of yoke from the housing, remove seat (67) and yoke spring (68). Seat (66) and rollpin (65) will be attached to yoke (64). Do not disassemble further unless seat (66) is damaged.

NOTE

Normally a wear pattern will exist on seat (66). If the seat is damaged or shows heavy wear, replace seat (66) and (67) and rollpin (65).

NOTE

If drive shaft (55) is defective, perform step E.17. If front bearing (69) was defective, perform steps E.17 and 18.

17. Remove bearing (69) from shaft (55) with the nine inch piece of 1½" heavy wall tubing shown in Figure 9. Press off with an arbor press.

18. Remove bearing race (70) from housing (33) as shown in Figure 16. Use special tool shown in Figure 10.

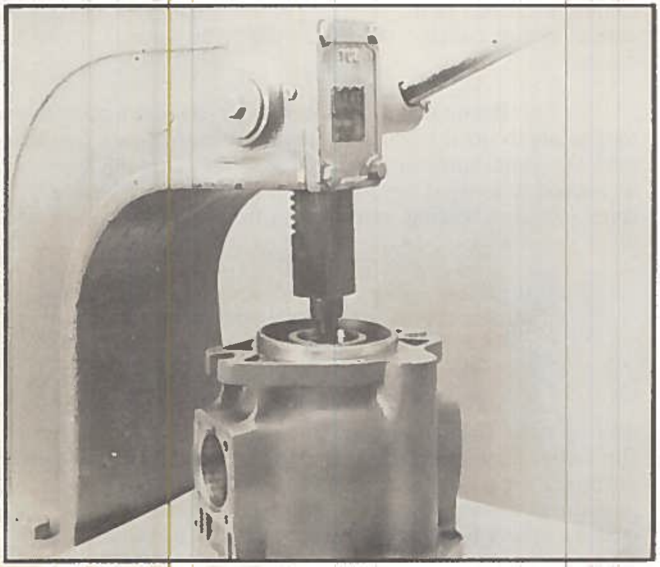


Figure 16. Removal of Front Bearing Race.

NOTE
PVE19-019 suffix models omit the following step.

19. Remove retaining ring (51) then press shaft seal (52) from pump housing (33).

NOTE
If yoke (64) and front shaft bearing (69) were not defective, perform the following step.

20. Remove and replace shaft seal (52) located within housing (33) as follows: (Refer to Figure 17.)

NOTE
PVE19-019 suffix models will use this step to remove a defective drive shaft only. In addition, references to shaft seal installation and removal must be omitted.

a. Install a nine inch piece of 1½" heavy wall tubing over drive shaft (55) within the housing. The end of the tubing will rest against the inner race of tapered roller bearing (69) and extend out beyond the end of the pump housing. Place the complete unit with tubing into an arbor press with drive spline up. Press the drive shaft through the bearing and out of the unit. A 0.001 press exists between the shaft and bearing so considerable force is required to remove the bearing. See Figure 17.

b. Remove retaining ring (51) and pull shaft seal (52) from housing (33). Be careful not to damage the aluminum die cast housing in the seal area.

c. Press drive shaft (55) into shaft bearing (69) as follows: Use a short piece of 1½" inch heavy wall tubing (approximately 6" long) over the drive spline of the shaft. The tubing must be long enough to go through the shaft seal end of the pump and make contact with the inner race of the front bearing. Press the shaft through the bearing with an arbor press until the bearing bottoms against the shoulder of the shaft. See Figure 18.

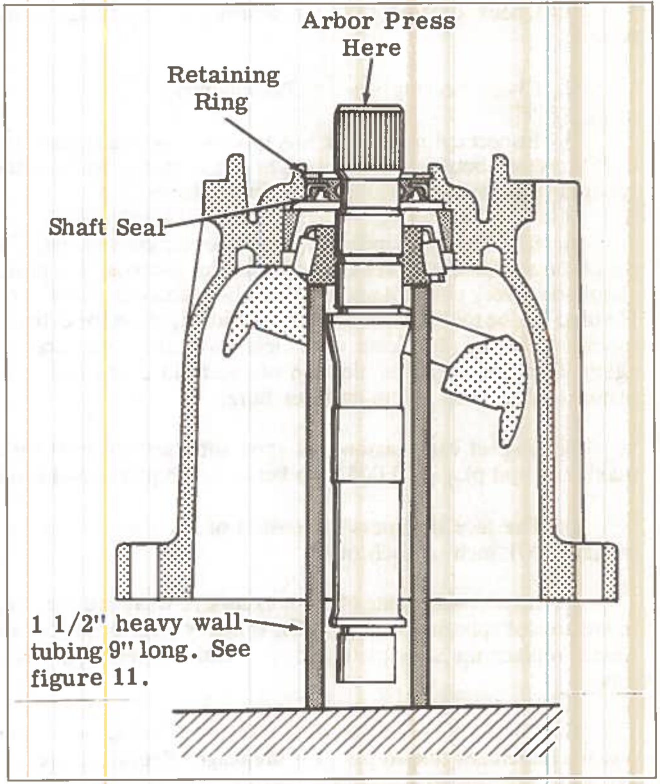


Figure 17. Front Bearing Removal.

d. Remove the short piece of tubing and turn shaft bearing (69) in its race with the end of the shaft. The bearing rollers must turn free and smooth.

e. Tape the spline end of drive shaft (55) with plastic tape to prevent cutting new shaft seal (52). Start taping the shaft close to the housing and work toward the end of the shaft. Install a new shaft seal in position over the shaft and press evenly into the housing. Use shaft seal driver shown in Figure 12. The seal must be positioned just below the retaining ring groove. Install retaining ring (51) into the housing. Use internal Truarc pliers to install retaining ring.

F. ASSEMBLY OF HOUSING PARTS

NOTE
If a new shaft bearing (69), shaft (55), valve block (32) or housing (33) is required, a complete preload adjustment must be performed. If the same parts are returned to service, the shaft bearing preload adjustment can be omitted. The same procedure applies to yoke (64) and its associated bearings.

1. If the shaft bearing (69) requires replacement, install a new bearing race (70) into housing (33). Use tool shown in Figure 11 to press bearing race in place. Make sure bearing race (70) is oriented properly to accept the roller bearing before pressing into the housing. The race must be bottomed against the shoulder of the housing at completion of press.

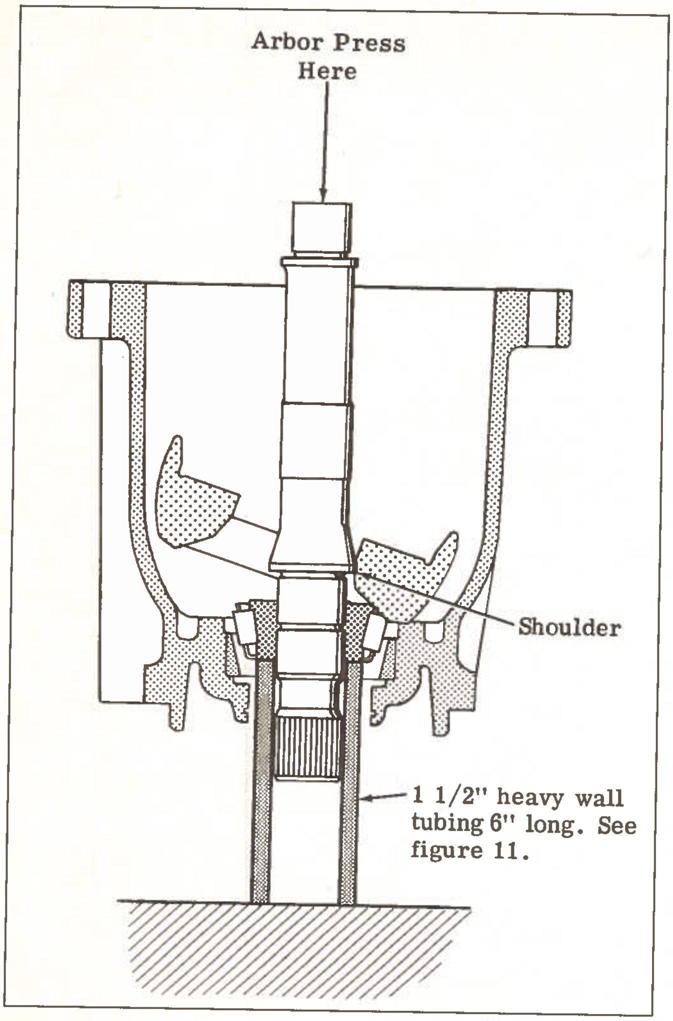


Figure 18. Front Bearing Installation.

2. Place housing (33) on a flat surface with the shaft seal end down. Lay front shaft bearing (69) into the race. Install yoke spring (68) and seat (67) into the housing.

3. Position the yoke pintles properly and install yoke into housing. Assemble yoke bearings, races and spacers as follows:

a. Assemble pintle bearings (63) on each end of the yoke and insert bearing races (62).

b. Install bearing spacer (61) at one pintle end.

c. Install "O" ring (60) against spacer (61) into the groove, then install a 0.010 inch shim (59) under pintle (58). Install four pintle cover screws (56) and torque to 175-185 lbf. in.

NOTE

Early designs used a screw and washer arrangement. These should be torqued to 115-125 lbf. ft.

d. Set housing (33) on its side so the other pintle is up. Install bearing spacer (61) and rotate the yoke back and forth to seat bearings (63) within the bearing races. With spacer (61) fully in against the bearing race, measure the height of the spacer with respect to the housing pintle face in two places (180° apart). Use a depth micrometer to perform this measurement. See Figure 19. Average the readings to obtain a nominal value. A 0.007-0.009 inch preload is required on the pintle bearings. Calculate the necessary shims to provide this preload as follows: Assume the depth readings were 0.029 and 0.027 inch. Add the two figures together and divide by 2 to obtain the average. In this case the calculated average is 0.028 inch. Subtract the nominal preload of 0.008 inch from the calculated average to obtain the required shim thickness.

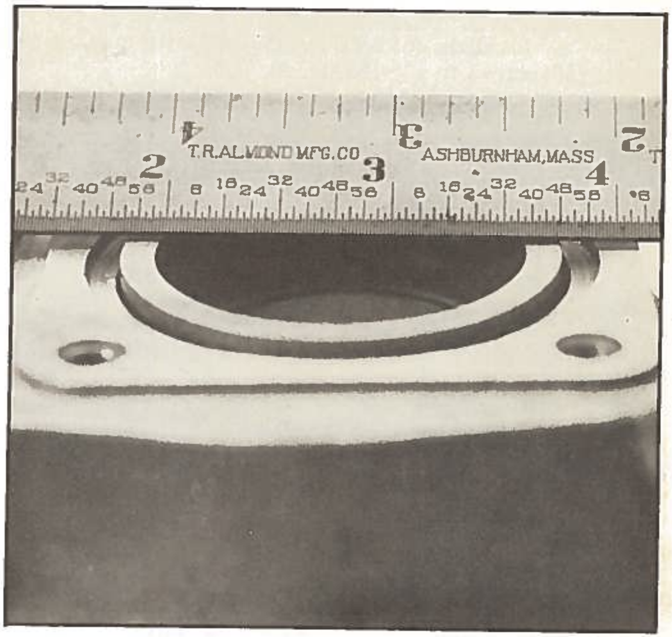


Figure 19. Pintle bearing spacer height with respect to pintle face.

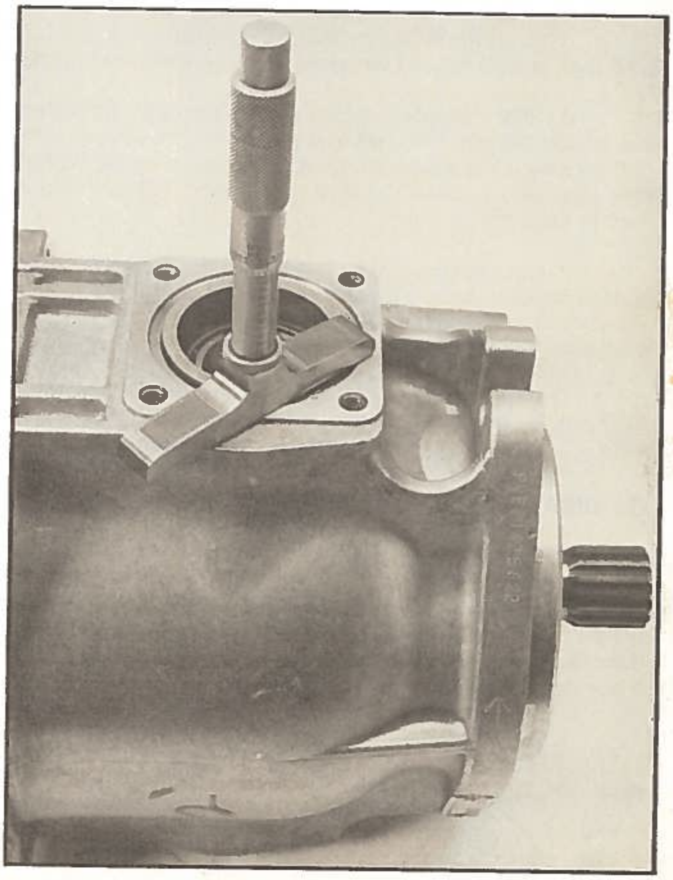


Figure 19a. Measuring height of pintle bearing spacer with respect to the pintle face.

NOTE

If the calculated shim thickness is greater than 0.020, another shim must be added to the opposite side of the yoke to reduce the total shim thickness to less than 0.020. Shim thickness at either pintle must not exceed 0.020. This is necessary to provide proper "O" ring compression and prevent pintle seal leakage.

e. Install the correct shims (59) and cross torque pintle cover (58) screws to 175-185 lbf. in.

NOTE

The yoke (64) will be stiff but should be loose enough to be moved by hand (approximately 20 lbf. in torque). The tightness/drag indicates the bearings are preloaded. If the yoke cannot be moved by hand, the preload is too great. Repeat the preload adjustment until correct.

4. Assemble the rotating group and install into housing as follows:

a. Assemble the spring, two washers and retaining ring into the cylinder block. The washer with three notches is assembled next to retaining ring. See Figure 14 for instructions. Set the cylinder block S/A (40) face on a flat clean surface. Use Kraft paper between the block and surface to prevent scratching the cylinder block face.

b. Install pin retainer (46) into cylinder block. Position the pin retainer approximately ¼" below the surface, and orient the open end of the pin retainer to be away from the large spline openings.

c. Slide the three pins (45) into cylinder block S/A (40) until they bottom against the spring washer within the block.

d. Place spherical washer (47) on top of the three pins; then install shoe plate (48) with nine piston and shoe subassemblies (49) over spherical washer (47) and into cylinder block. Wobble shoe plate (48) to make sure that each piston is free within its bore in the cylinder block.

e. Set housing (33) on its side and hold pump shaft (55) horizontal. Slide rotating group into the housing. Rotate the shaft to match the shaft splines to the cylinder block and spherical washer.

5. If alignment pins (37) were removed, install two alignment rollpins (37) into housing (33). Place gasket (36) over the rollpins, cover with Kraft paper and set aside for final assembly.

G. DISASSEMBLY OF VALVE BLOCK

1. Do not disassemble check valve parts (72) through (74), unless action of the valve indicates a problem. Check the valve action with a pencil or a screwdriver. Press the check valve in against the spring, it should return and hold firm against the seat. If the check valve is defective, remove and replace the complete assembly. Press new seat (72) flush with face of valve block. DO NOT scratch the face of valve block (32).

2. Remove parts (75) through (82) from valve block (32); parts (75) and (76) exist only on the PVE19G*-019 model.

NOTE

If bearing (38) was defective, perform the following step.

3. Remove bearing race (71) from valve block (32). Refer to Figure 20 for removal information and use tool shown in Figure 10 for PVE**G units. Use tool shown in Figure 10a and procedure shown in Figure 20a for PVE** units with a blind hole in valve block (32). BE CAREFUL not to scratch face of the valve block during removal of the race.

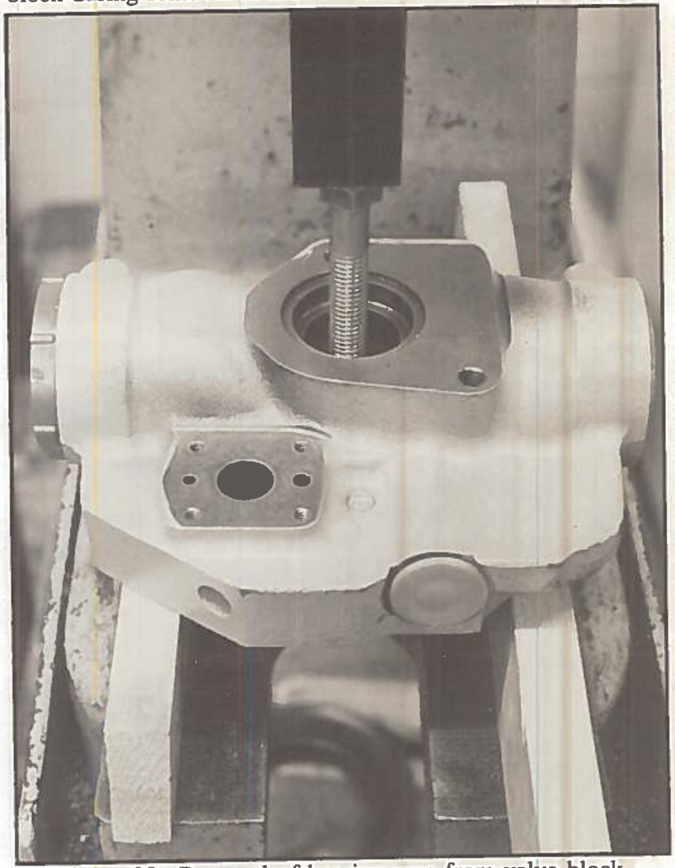


Figure 20. Removal of bearing race from valve block.

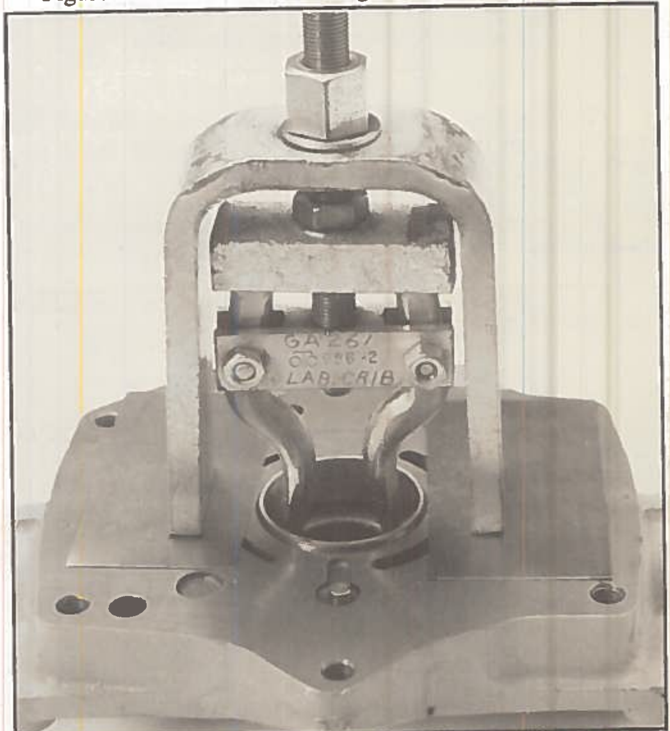


Figure 20a. Removal of bearing race from valve block with blind hole.

H. INSPECTION, REPAIR AND REPLACEMENT

1. Clean all parts and place them on a clean sheet of Kraft paper for inspection. Follow general procedure noted in paragraph VI. GENERAL.

2. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs. If threads are defective, replace the plug.

3. Inspect compensator piston rod (82) for nicks and burrs. Remove burrs and sharp edges with an India stone.

4. Inspect compensator piston (80) for wear at the area of yoke contact. The compensator piston and the piston rod are a close tolerance fit and must assemble together without evidence of wear or bind. Rotate the piston through 360° when checking for bind.

5. Inspect valve block (32) for burrs, nicks, plugged body passages, flatness of the pump wafer plate area and porosity. Inspect check valve seat (72). Make sure the seat is tight within the valve block and does not protrude above the valve block face. Repair or replace the valve block if defective.

I. ASSEMBLY OF VALVE BLOCK

NOTE
Refer to Figure 13 during the following assembly procedures.

1. If bearing (38) was defective and bearing race (71) has been removed, a new bearing race must be installed into the valve block. Refer to Figure 21 and press a new bearing race in place with an arbor press. The bearing race must bottom against the shoulder of valve block at completion of press.

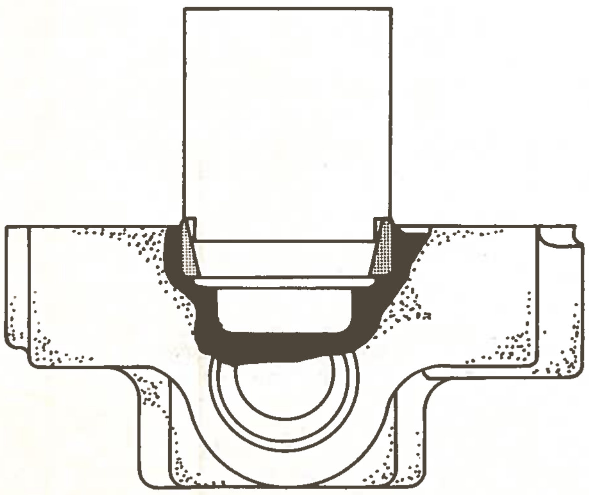


Figure 21. Installation of bearing race into valve block.

NOTE
Check flatness of the valve block face in the area around each locating pin hole (37) and at bolt openings (30). Use an India stone to remove burrs or raised metal in these areas.

2. Install pipe plug (77) into valve block (3)2) and secure.

3. Assemble a new "O" ring (76) on hex plug (75) and thread plug into place. Note: This step pertains to PVE19-019 units only.

J. SHAFT BEARING PRELOAD ADJUSTMENT

NOTE
If the shaft bearings, shaft, valve block or housing were not replaced, use the bearing spacer removed during the disassembly procedure to preload the shaft and perform step J.7. If preload adjustment is necessary, perform steps J.1 through J.7.

1. Install the thickest bearing spacer (39) over shaft (55) with the chamfer facing into the housing (toward the shoulder on the shaft).

2. Slide new bearing (38) on the shaft and up against spacer (39). The small diameter of the tapered roller bearing must face out of the housing.

3. Install housing (33) to valve block (32) without gasket (36) and rotating group. Turn shaft (55) to seat the bearings then torque the six housing attaching screws (30) to 5 lbf. in. Check the opening between the valve block and housing to be as even as possible after tightening.

4. Use a feeler gauge to measure the opening between valve block (32) and housing (33). Four measurements should be obtained equidistant around the unit. A tapered feeler gauge is especially useful for this purpose. Average the four readings by adding them together and dividing by 4. Calculate thickness of the shaft bearing spacer as follows:

+0.150	Measured thickness of bearing spacer
−0.027	Average gap (estimated)
+0.003 ± 0.001	Preload setting
+0.020	Compressed thickness of gasket
0.146 ± 0.001	Required bearing spacer thickness to provide a 0.003 ± .001 bearing preload.

5. Remove six mounting screws (30) then remove housing (33) from the valve block.

6. Remove bearing (38) and bearing spacer (39).

7. Locate a bearing spacer with calculated dimensions and place next to the new bearing on the shaft. Chamfer must face shoulder on shaft. Use the original spacer and bearing if preload is not performed. Set aside for final assembly.

K. FINAL ASSEMBLY OF THE PVE SERIES PUMP

NOTE
Lubricate all moving parts of the piston pump with system fluid to facilitate assembly and provide initial lubrication. Pour system fluid liberally over the rotating group and wafer plate as these parts are without lubrication until the pump primes.

1. Assemble wafer plate locating pin (35) into valve block (32). Refer to Figure 13.

2. Assemble wafer plate (34) over the bearing race and locating pin (35) with wear surface away from valve block (32). Determine from the model code which wafer plate is used. See Figure 22.

CAUTION

The wafer plate must be flat against the valve block face. Check to make sure it does not rock back and forth. If rocking of the wafer plate occurs, check locating pin (35), it may not be bottomed out in the valve block. Rocking of the wafer plate will induce high stress conditions across the wafer plate and cause fractures to appear.

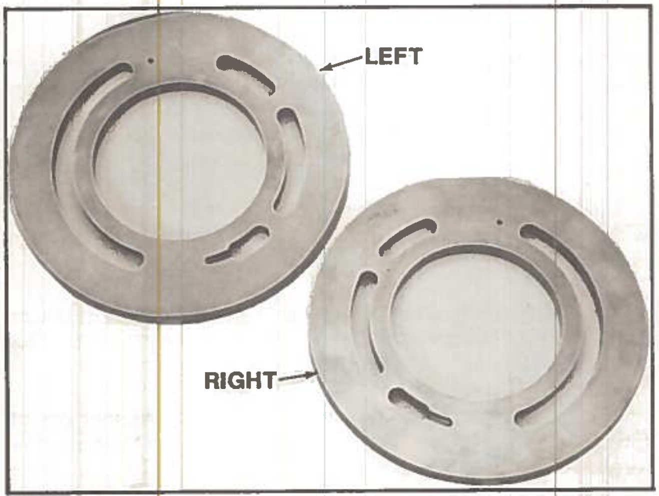


Figure 22. Wafer plates showing right and left hand.

3. Place valve block (32) on its side. See Figure 13 for position required.

4. Install compensator piston rod (82) into valve block (32) and attach spirolox retaining ring (79).

5. Install a new "O" ring (78) in the compensator piston rod "O" ring groove.

6. Install compensator piston (80) over compensator piston rod (82).

7. Assemble housing (33) and valve block (32) together as shown in Figure 13. Thread six screws (30) handtight through the housing into the valve block. Cross torque the screws to bring the valve block and housing together against gasket (36). Final torque screws (30) to 31-35 N.m (23-26 lbf. ft.).

8. Check the shaft torque to verify correct bearing preload. If the torque exceeds eight (8) N.m (6 lbf. ft.), perform a shaft bearing preload adjustment, Section VI.J. and repeat steps VI.K.7 and 8.

9. Determine shaft rotation from the model code stamped on the mounting flange. Refer to Figure 7 and mount the compensator subassembly. Thread four screws (5) through the compensator into valve block (32). Cross torque screws to 7-8 N.m (60-70 lbf. in.).

10. Install "O" ring (4) over the pilot flange of gear pump (2). Slide coupling (3) over the shaft and assemble the gear pump to the valve block with two screws (1). Torque screws to 21-24 N.m (16-18 lbf. ft.).

Section VII – TEST PROCEDURE

A. TEST CONDITIONS

1. Fluid Medium: SAE 10W meeting API service classification MS or equivalent.

2. Fluid Temperature: 120° ± 5° F. at pump outlet.

3. Fluid entering the pump must be maintained below a maximum contamination limit of class four according to NAS1638.

B. PRELIMINARY CHECK

1. Rotate the drive shaft through one complete revolution. The shaft must rotate with less than 8 N.m (6 lbf. ft.) torque and be free without evidence of binding.

2. Direction of rotation by the model code stamped into the edge of the mounting flange. See Table 1 for definition of model code variables.

C. PRELIMINARY SET-UP

NOTE

Install unit as shown in test circuit diagram with case drain up. Use the correct circuit diagram for the unit: Figure 23 - PVE19/21 (G)-*-**-C/CG-1*. Figure 24 - PVE19/21 (G)-*-**-CV/CVP/CVPC units.

1. Maintain 0-10 Psig at pump inlet.

2. Fill pump housing with system fluid and connect case drain line.

3. During test, case pressure must not exceed 15 Psig.

4. Pressure differential between case and inlet must be 0-5 psid unless otherwise indicated. (Note: A special test for maximum differential pressure between case and inlet will be performed later.)

D. PERFORMANCE TEST

1. Open globe valves V1 and V2.

2. Set load valve one (1) to minimum pressure. If the unit has an auxiliary gear pump, set load valve two (2) to minimum pressure.

3. Turn compensator plug (9), Figure 13, clockwise until seated.

4. Jog the unit under test until prime occurs. If the unit has an auxiliary gear pump, both pumps must prime before proceeding.

5. Operate the unit at 1200 RPM and 100 Psig until all air is expelled from the test circuit.

6. Piston pump case leakage must exceed 10cc/minute as read on flow rater Q2.

E. GEAR PUMP PERFORMANCE EVALUATION

1. Adjust gear pump load valve two (2) to exactly 100 Psig at gauge P4. Flow rater Q3 should read 3.87 USGPM minimum at 1200 RPM.

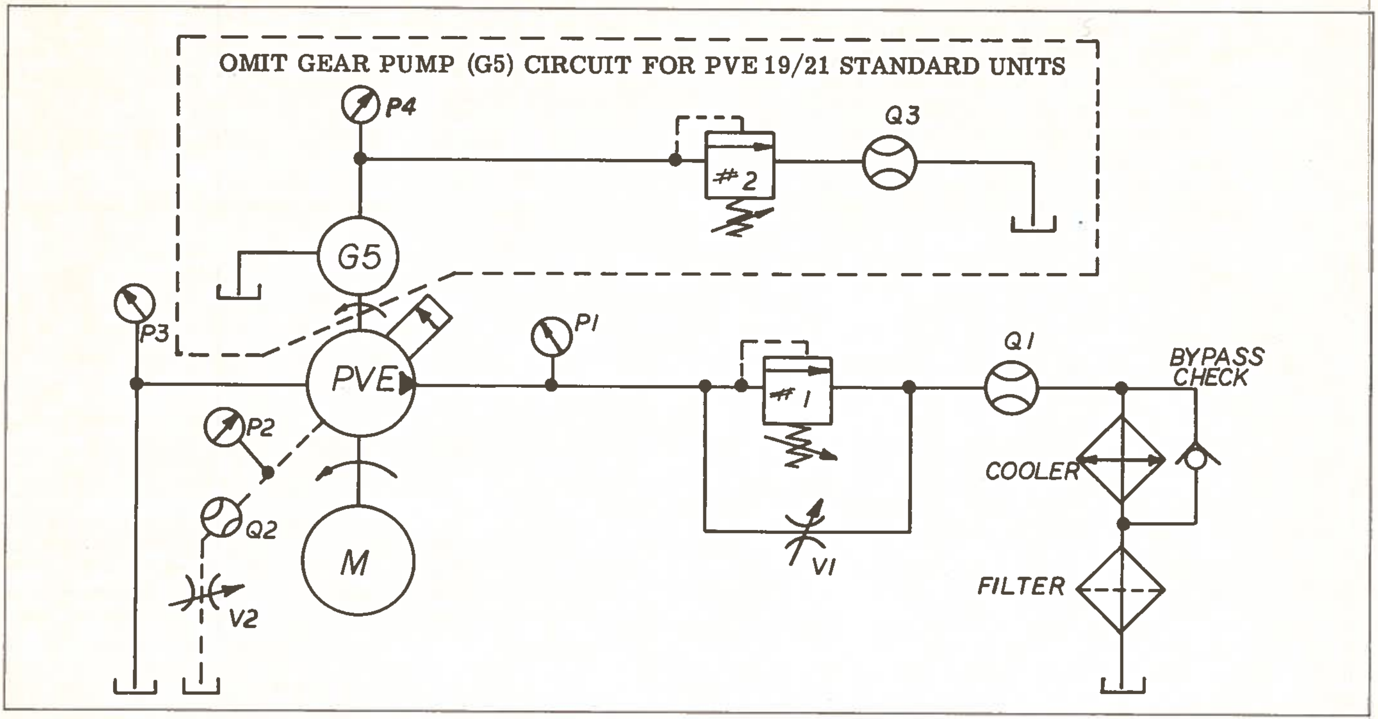


Figure 23. Circuit Diagram for "C" & "CG" Control

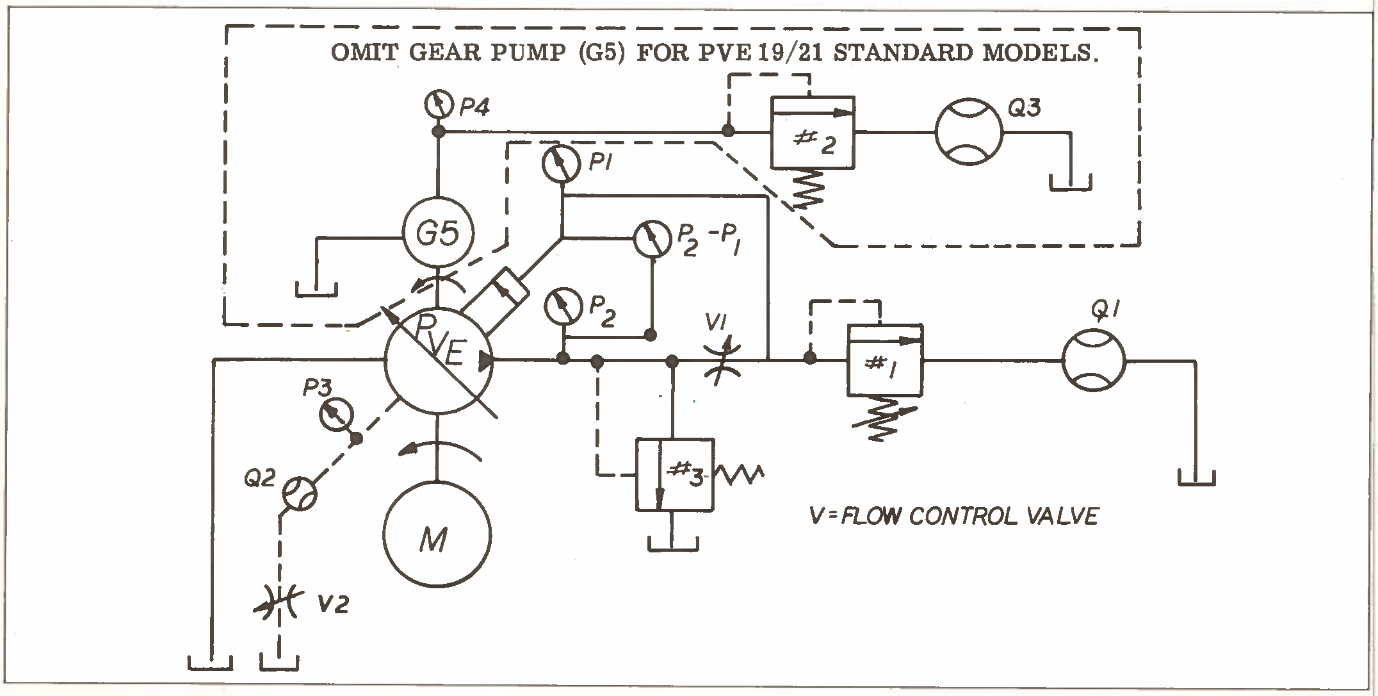


Figure 24. Circuit Diagram for "CV", "CVP" & "CVPC"

2. Adjust load valve two (2) for 2300 Psig at gauge P4. Flow rater Q3 should read 3.7 USGPM minimum.

3. Return load valve two (2) to 100 Psig at P4. This completes the test of the G5-12 gear pump.

F. PERFORMANCE TEST OF PVE19/21 PISTON PUMP WITH "C" COMPENSATOR CONTROL

1. Adjust load valve one (1) and globe valve one (1), Figure 23, for exactly 100 Psig as read at gauge P1. The unit must meet the following requirements at full stroke, and 1200 RPM. See Table 4. Record the flows obtained.

2. Close globe valve one (1) and readjust load valve one (1) to system pressure shown in Table 5. Read Psig at gauge P1.

3. Check delivery loss and case leakage as follows. (See Table 5.)

4. Back off compensator adjustment screw until approximately 0.060 inches of threads are exposed. Close load valve

100 PSI SYSTEM PRESSURE		
MODEL	PVE19	PVE21
Delivery	12.5 - 13.5 USGPM	13.75 - 14.85 USGPM
Max. Case Leakage	800cc/MINUTE	800cc/MINUTE

Table 4. Maximum flow and maximum case leakage at 100 Psig.

3000 Psig SYSTEM PRESSURE		2700 Psig SYSTEM PRESSURE
MODEL	PVE19	PVE21
Max. Delivery	1.50 USGPM	1.50 USGPM
Loss Max. Case Leakage	1.45 USGPM	1.45 USGPM

Table 5. Delivery loss and maximum allowable leakage at indicated Psig.

one (1) and globe valve one (1). The pressure as read at gauge P1 must not exceed 250 Psig.

5. Adjust the compensator screw to retract the yoke to minimum stroke position at Table 6 pressures. Case drain leakage not to exceed two (2.0) USGPM. Pressure fluctuations must not exceed 50 Psig. Rapid globe valve (V1) movement from open to closed must not produce yoke hunting.

6. With the pump operating at cutoff, close the case drain port slowly (globe valve V2) while observing gauge P2. Pressure differential P2-P3 must be 6-12 Psid with globe valve V2 fully closed. If pressure starts to exceed 12 Psid while closing globe valve V2, the internal check valve is malfunctioning. DO NOT close globe valve V2 further; return to the open condition and repair the malfunction.

MODEL NUMBER	LOCKWIRE	PRESSURE SETTING
PVE19*-*-**-C-10	Yes	3000 Psig
PVE21*-*-**-C-10	Yes	2700 Psig

Table 6. Final compenstor pressure setting.

7. With load valve one (1) set to pressure noted in Table 6 and globe valve V1 fully closed, the pressure at P1 must return within 50 Psig of initial setting.

8. Drill and lockwire the compensator adjusting screw (9) Figure 13.

9. Check for signs of external leakage (none permissible) including shaft seal.

10. Remove power, remove unit from stand, drain case, then plug openings to prevent dirt from entering the unit. This completes test and adjustment of the piston pump and "C" compensator S/A.

G. PERFORMANCE TEST OF PVE19/21 PISTON PUMP WITH "CG" COMPENSATOR CONTROL

1. Operate pump at 1200 RPM. Set remote control valve to minimum pressure setting.

2. Refer to Figure 23 and adjust load valve (1) and globe valve (1) to 100 PSI system pressure at P1. Observe maximum pump flow and maximum case leakage requirements noted in Table 4.

3. Close load valve (1) and globe valve (1) to obtain minimum pump pressure setting. Minimum pump pressure should be approximately 250 PSI at P1.

NOTE

The "CG" compensator is preset at the factory at 250-350 PSI. When a hydraulic line is attached between the "CG" compensator and remote control valve, back pressure may exist within the hydraulic line. As a result, the back pressure may keep the minimum pump pressure above 350 PSI.

4. Adjust load valve (1) to maximum system pressure shown in Table 5. Check pump delivery loss and case leakage requirements from Table 5.

5. Close load valve (1). Increase the remote control valve setting until the pump yoke retreats to minimum stroke position. Observe pressure at P1. Case leakage should not exceed 2 GPM. Open and close load valve (1). The pressure at P1 should return within 50 PSI of initial setting.

6. Check the pump for external leakage. No external leakage is permissible.

H. PERFORMANCE TEST OF PVE19/21 PISTON PUMP WITH "CV", "CVP" AND "CVPC" COMPENSATOR CONTROL

NOTE

Refer to Figure 24 for location of circuit components.

1. Open load valve one (1) and turn compensator adjustment plug clockwise until seated.

2. Operate at 1200 RPM and 100 Psig outlet pressure until all air is removed from the test circuit.

3. The case leakage as read at flow rater Q2 must exceed 10cc/minute. Make sure globe valve V2 is open.

4. Adjust globe valve V1 closed. Then adjust relief valve three (3) to a pressure higher than the compensator setting noted in Table 8.

5. Open globe valve V1 and set load valve one (1) for 100 Psig as read at gauge P2.

6. The unit must meet the following requirements at 1200 RPM and full stroke. See Table 7. Record the flow readings.

100 Psig SYSTEM PRESSURE		
MODEL CODE	DELIVERY	MAX. CASE LEAKAGE
PVE19*-*-**-CV-10	12.5 - 13.5 USGPM	800cc/ MINUTE
PVE21*-*-**-CV-10	13.75 - 14.85 USGPM	800cc/ MINUTE
PVE19*-*-**-CVP/CVP-12	12.45 - 13.45 USGPM	1200cc/ MINUTE
PVE21*-*-**-CVP/CVPC-12	13.7 - 14.8 USGPM	1200cc/ MINUTE

Table 7. Maximum delivery and maximum case leakage.

7. Adjust load valve one (1) for pressures noted in Table 8. Check the delivery loss by comparing flow at the highest system pressure setting to the flow at 100 Psig. (Note: CVP and CVPC compensators may require an adjustment to obtain a full stroke at system pressure.) Make sure relief valve three (3) is not bypassing fluid to tank. The unit must meet the following requirements at full stroke and 1200 RPM.

SYSTEM PRESSURE / MODEL CODE	Psig	DELIVERY LOSS	MAX. CASE LEAKAGE
PVE19*-*-**-CV-10	3000	1.5 USGPM	1.45 USGPM
PVE21*-*-**-CV-10	2700	1.5 USGPM	1.45 USGPM
PVE19*-*-**-CVP/CVPC-12	3000	1.65 USGPM	1.70 USGPM
PVE21*-*-**-CVP/CVPC-12	2700	1.65 USGPM	1.70 USGPM

Table 8. Delivery loss and maximum case leakage.

8. Units with a CV, CVP or CVPC compenstor S/A shall perform the compensator control and integral case to inlet test. Refer to steps F1 through F6. Set compensator pressure as shown in Table 6.

I. LOAD SENSING CONTROL TEST

1. At 1200 RPM, load the pump outlet port pressure to 2000 ±50 Psig with load valve one (1). Shim the load sensing compensator spool to obtain a differential pressure P1 - P2 per Table 9 with globe valve V1 adjusted for 6.5 ± .25 USGPM outlet flow and gauge P1 at 2000 Psig.

2. Vary the outlet flow from 0.5 USGPM to maximum with globe valve one (1). Pump outlet pressure must be stable.

3. Set globe valve one (1) fully open. Differential pressure P2 - P1 will be at minimum. Slowly close globe valve V1 while observing the differential pressure gauge P2 - P1 and flow rater Q1. A point will be reached (compensator cracking pressure) where flow will start to diminish; pressure gauge P2 - P1 should read the value noted in Table 9.

4. Cycle the pump from minimum to maximum flow with globe valve one (1), pump outlet must be stable. At minimum pump flow, the standby pressure P2 after P1 has decayed to zero (0) must correspond to Table 9. Lockwire the compensator adjustment plug.

5. Check for external leakage (none permissible).

6. Disconnect and drain the unit under test. Plug all openings to prevent contamination.

MODEL	COMPENSATOR PRESSURE SETTING Psig	LOCKWIRE	STANDBY PRESSURE P2	P @ 6.5 USGPM (P2 - P1)	P @ COMPENSATOR CRACKING PRESSURE (P2 - P1)
PVE19*-*-**-CV-10	Not Applicable	Yes	250 Psig Max.	160 ±20 Psig	160^{+20}_{-30} Psig
PVE21*-*-**-CV-10	Not Applicable				
PVE19*-*-**-CVP-12	3000				
PVE21*-*-**-CVP-12	2700				
PVE19*-*-**-CVPC-12	3000	Yes	550 Psig Max.	365 ±25 Psig	360^{+20}_{-30} Psig
PVE21*-*-**-CVPC-12	2700				
PVE19G5-6L-9-20-CVP-019	2300	Yes	250-350 Psig	230 ±20 Psig	230^{+20}_{-30} Psig

Table 9. Load sensing compensator adjustment range.

VICKERS®
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Service Parts Information

HEAVY DUTY PISTON PUMP STANDARD/ THRU DRIVE

PVE27QI*-**-(M)(D)-22-C(*)V-21

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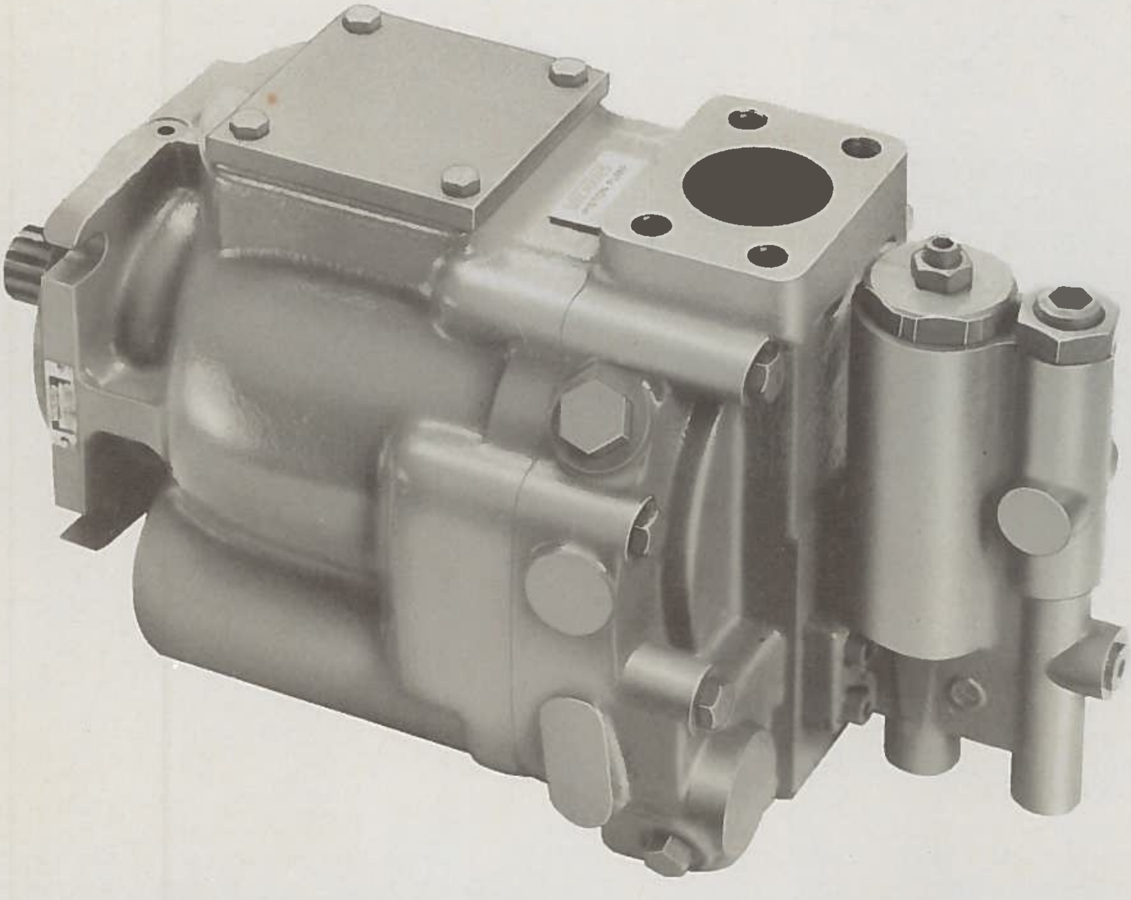

Vickers, Incorporated

1401 Crooks Road
Troy, Michigan 48084

Released 8-1-88 M-2235-S

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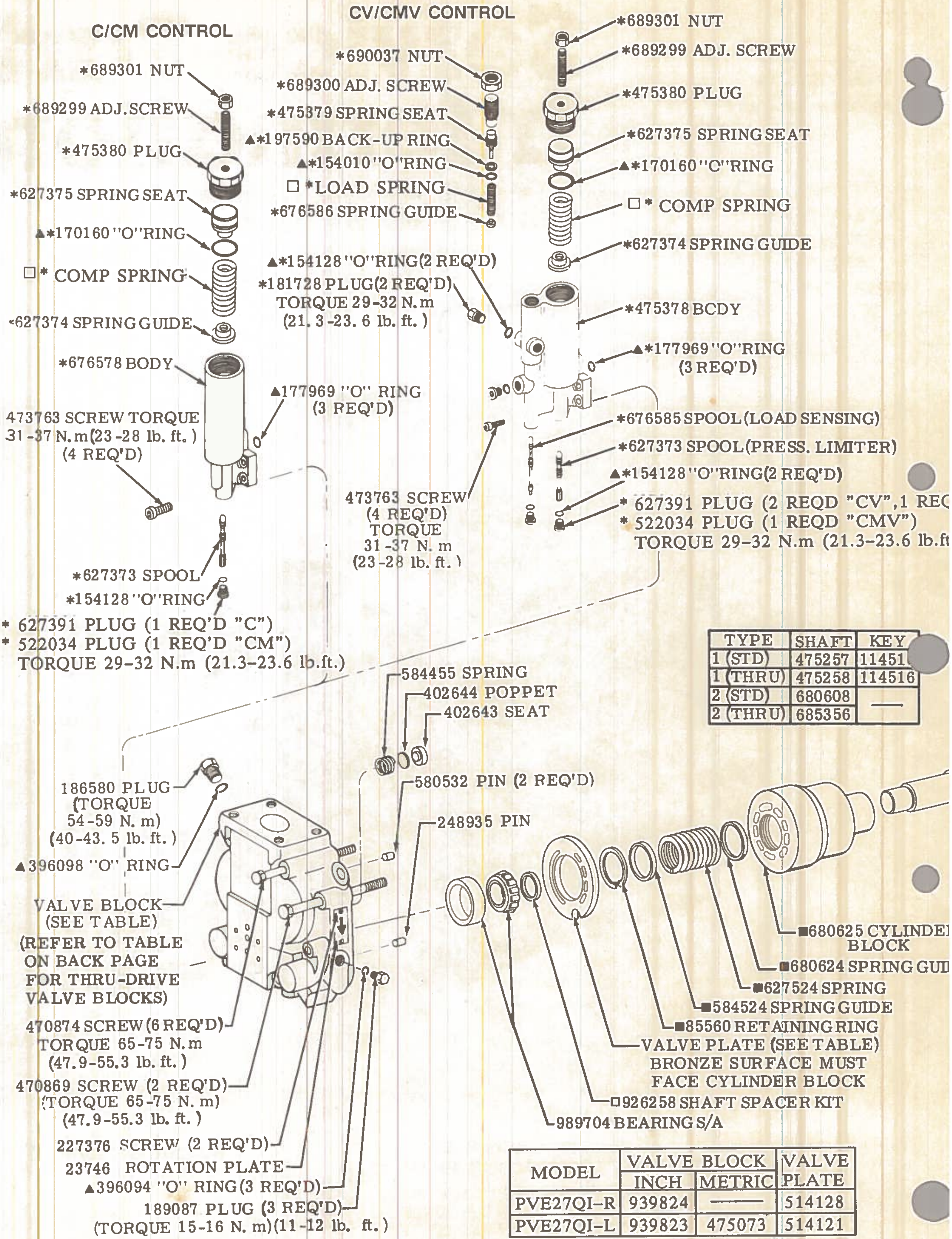

C/CM CONTROL
*689301 NUT
*689299 ADJ.SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O"RING
□* COMP SPRING
*627374 SPRING GUIDE
*676578 BODY
473763 SCREW TORQUE 31-37 N.m(23-28 lb. ft.) (4 REQ'D)
▲177969 "O" RING (3 REQ'D)
*627373 SPOOL
*154128 "O"RING
* 627391 PLUG (1 REQ'D "C")
* 522034 PLUG (1 REQ'D "CM")
TORQUE 29-32 N.m (21.3-23.6 lb.ft.)
CV/CMV CONTROL
*690037 NUT
*689300 ADJ. SCREW
*475379 SPRING SEAT
▲*197590 BACK-UP RING
▲*154010 "O"RING
□ *LOAD SPRING
*676586 SPRING GUIDE
▲*154128 "O"RING(2 REQ'D)
*181728 PLUG(2 REQ'D) TORQUE 29-32 N.m (21.3-23.6 lb. ft.)
473763 SCREW (4 REQ'D) TORQUE 31-37 N. m (23-28 lb. ft.)
*689301 NUT
*689299 ADJ. SCREW
*475380 PLUG
*627375 SPRING SEAT
▲*170160 "O"RING
□* COMP SPRING
*627374 SPRING GUIDE
*475378 BODY
▲*177969 "O"RING (3 REQ'D)
*676585 SPOOL (LOAD SENSING)
*627373 SPOOL (PRESS. LIMITER)
▲*154128 "O"RING(2 REQ'D)
* 627391 PLUG (2 REQD "CV",1 REQ
* 522034 PLUG (1 REQD "CMV")
TORQUE 29-32 N.m (21.3-23.6 lb.ft
584455 SPRING
402644 POPPET
402643 SEAT
580532 PIN (2 REQ'D)
248935 PIN
186580 PLUG (TORQUE 54-59 N. m) (40-43. 5 lb. ft.)
▲396098 "O" RING
VALVE BLOCK (SEE TABLE) (REFER TO TABLE ON BACK PAGE FOR THRU-DRIVE VALVE BLOCKS)
470874 SCREW (6 REQ'D) TORQUE 65-75 N.m (47.9-55.3 lb. ft.)
470869 SCREW (2 REQ'D) (TORQUE 65-75 N. m) (47.9-55.3 lb. ft.)
227376 SCREW (2 REQ'D)
23746 ROTATION PLATE
▲396094 "O" RING (3 REQ'D)
189087 PLUG (3 REQ'D) (TORQUE 15-16 N. m)(11-12 lb. ft.)
■680625 CYLINDE BLOCK
■680624 SPRING GUI
■627524 SPRING
■584524 SPRING GUIDE
■85560 RETAINING RING
VALVE PLATE (SEE TABLE) BRONZE SURFACE MUST FACE CYLINDER BLOCK
□926258 SHAFT SPACER KIT
989704 BEARING S/A

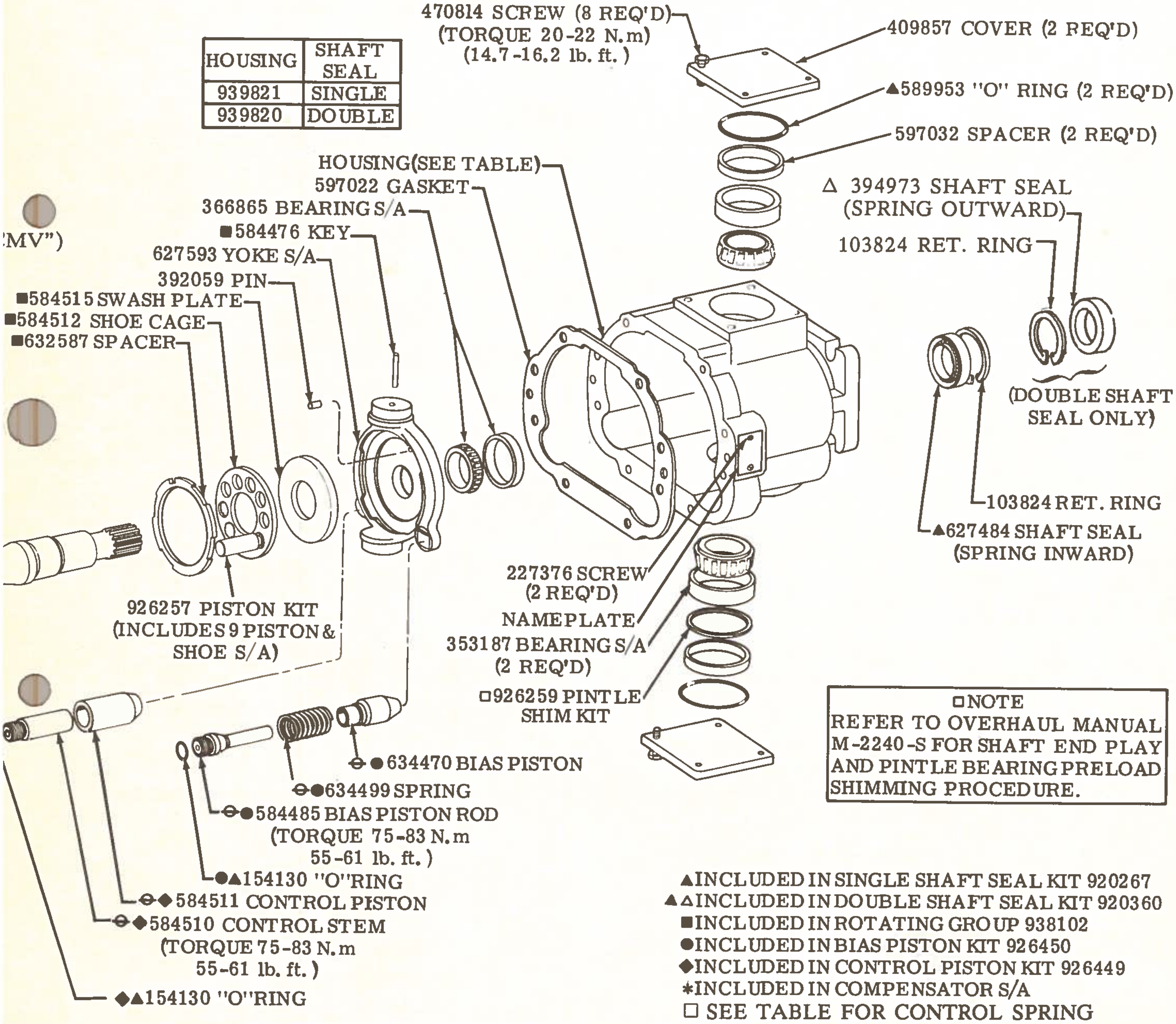
TYPE	SHAFT	KEY
1 (STD)	475257	11451
1 (THRU)	475258	114516
2 (STD)	680608	——
2 (THRU)	685356	

MODEL	VALVE BLOCK		VALVE PLATE
	INCH	METRIC	
PVE27QI-R	939824	——	514128
PVE27QI-L	939823	475073	514121

PVE27QI*-**-(M)(D)-22-C(*)V-21

MODEL CODE	*CONTROL S/A	CONTROL SPRING		MAX. CONTROL PRESS. SETTING	
		☐ COMP	☐ LOAD	PRESS. COMP.	LOAD SENSE Δ P
C	475407	631529	———	250 BAR (3625 PSI)	———
CM	521956	522003	———	70 BAR (1015 PSI)	———
CMV	567709	522003	628273	70 BAR (1015 PSI)	20 BAR (290 PSI)
CV (STD)	475405	631529	628273	250 BAR (3625 PSI)	20 BAR (290 PSI)
CV (LOW PRESS.)	475104	631529	690841	250 BAR (3625 PSI)	17 BAR (246 PSI)

HOUSING	SHAFT SEAL
939821	SINGLE
939820	DOUBLE



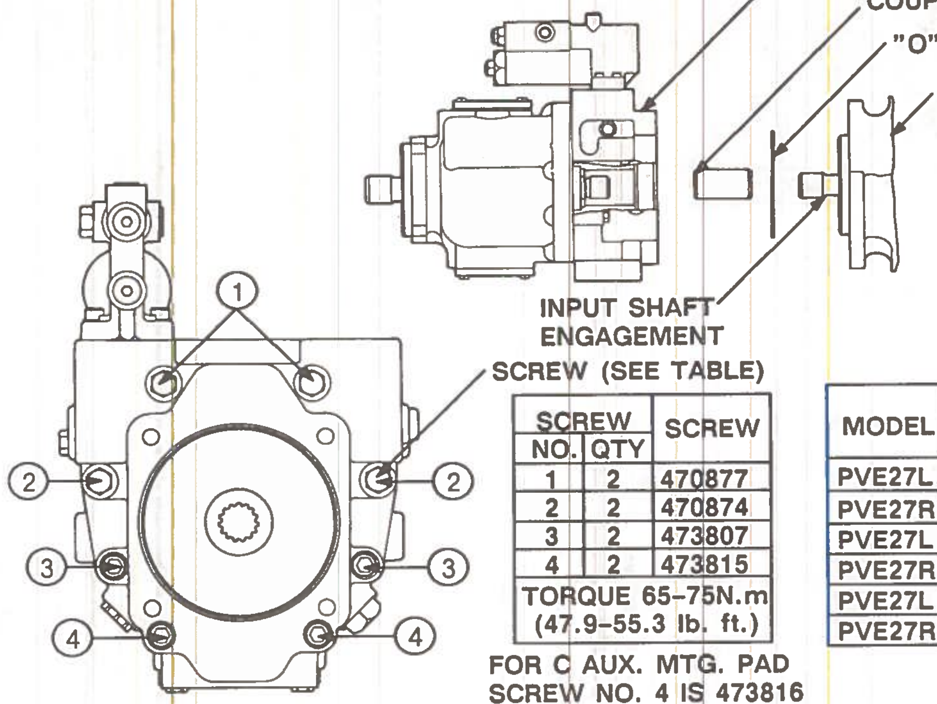
☐NOTE
REFER TO OVERHAUL MANUAL M-2240-S FOR SHAFT END PLAY AND PINTLE BEARING PRELOAD SHIMMING PROCEDURE.

▲INCLUDED IN SINGLE SHAFT SEAL KIT 920267
▲ΔINCLUDED IN DOUBLE SHAFT SEAL KIT 920360
■INCLUDED IN ROTATING GROUP 938102
●INCLUDED IN BIAS PISTON KIT 926450
◆INCLUDED IN CONTROL PISTON KIT 926449
*INCLUDED IN COMPENSATOR S/A
☐ SEE TABLE FOR CONTROL SPRING

⊖NOTE
PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION

▲ NOTE
ALL SEALS MARKED ▲ INCLUDED IN DOUBLE SHAFT SEAL KIT.

THRU-DRIVE MODELS



VALVE BLOCK (SEE TABLE) (INCH ONLY)

COUPLING (SEE TABLE)

"O"RING (SEE TABLE)

REAR PUMP

INPUT SHAFT ENGAGEMENT

SCREW (SEE TABLE)

INPUT SHAFT ENGAGEMENT (REAR PUMP)	COUPLING
SAE-A	685430
SAE-B	685429
SAE-BB	685428
SAE-C	429368

SCREW NO.	QTY	SCREW
1	2	470877
2	2	470874
3	2	473807
4	2	473815
TORQUE 65-75N.m (47.9-55.3 lb. ft.)		

FOR C AUX. MTG. PAD SCREW NO. 4 IS 473816

MODEL	AUX. MTG. PAD	VALVE BLOCK		"O"RING
		INCH	METRIC	
PVE27L	A	522228	521980	576601
PVE27R	A	939835	———	
PVE27L	B	939834	———	401525
PVE27R	B	939878	———	
PVE27L	C	939831	———	353264
PVE27R	C	939830	———	

MODEL CODE BREAKDOWN

P V E 27(QI) * - * * (M) (D) - 22 - C (25) V - 21

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 PUMP

2 VARIABLE

3 E SERIES

4 FLOW RATING

27 - 27 GPM @ 1800 RPM (3.5 CIR)

5 QUIET VERSION

6 SHAFT ROTATION (VIEWED FROM SHAFT END)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 PORTS & CONFIGURATION

BLANK - SIDE PORT, FLANGED REAR MOUNT CONTROL
H - SIDE PORT 'A' PAD AUX. MOUNT SIDE MOUNT CONTROL

THRU DRIVE CONFIGURATION
A - SIDE PORT 'A' PAD AUX. MOUNT, SIDE MOUNT CONTROL
B - SIDE PORT 'B' PAD AUX. MOUNT, SIDE MOUNT CONTROL
C - SIDE PORT 'C' PAD AUX. MOUNT, SIDE MOUNT CONTROL

8 INPUT SHAFT

1 - STRAIGHT KEYED
2 - SPLINED

9 PORT DESIGNATION

(4 BOLT FLANGE)
BLANK - SAE I-518
M - ISO/DIS 6162

10 SHAFT SEAL

BLANK - SINGLE
D - DOUBLE

11 PUMP DESIGN

12 CONTROL OPTION

C - PRESSURE COMPENSATOR (STD.)
CM - PRESSURE COMPENSATOR (LOW PRESS.)

13 PRESSURE COMP. SETTING

25 - 250 BAR (3625 PSI) ("C" CONTROL)
7 - 70 BAR (1015 PSI) ("CM" CONTROL)

14 CONTROL OPTION

V - LOAD SENSING PRESS. LIMITING
20 BAR (290 PSI) - ("CMV & "CV" STD.)
17 BAR (246 PSI) - ("CV" LOW PRESS.)

15 CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 19/15 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

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Service Parts Information

Heavy
Duty
Piston
Pumps

PVD45**-**-22-********-1*

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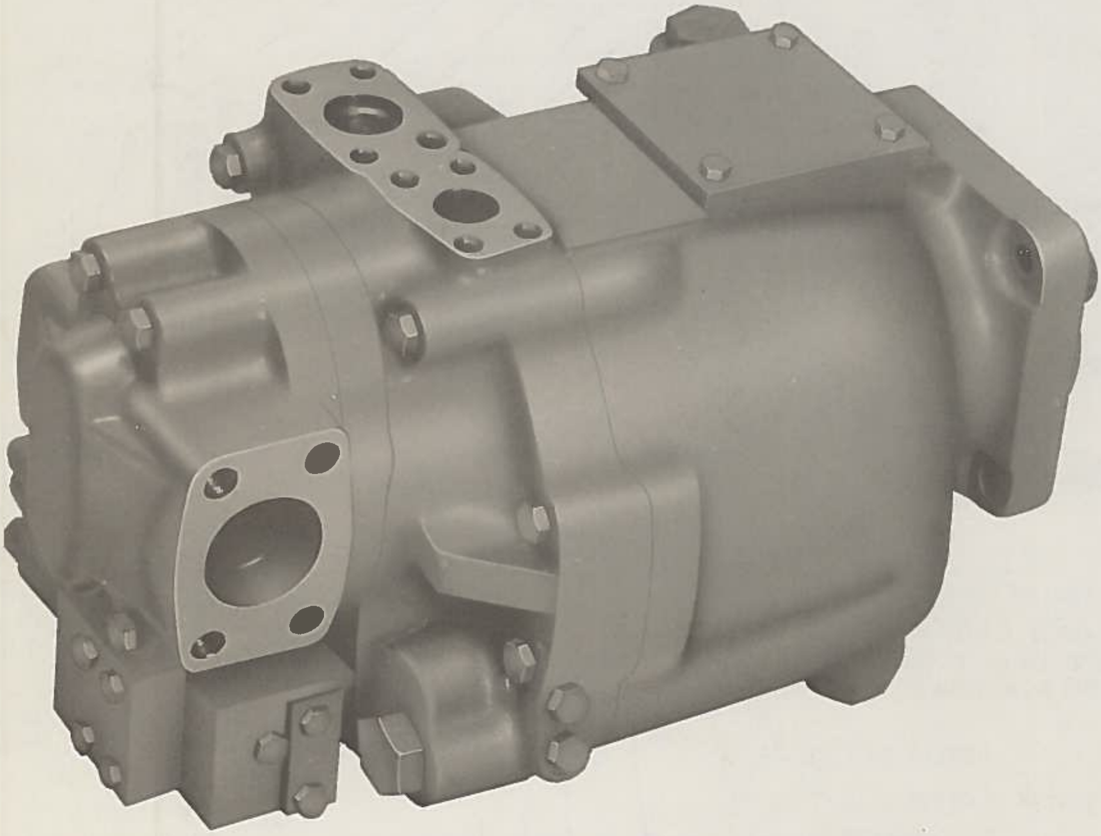

Vickers, Incorporated

1401 Crooks Road
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Revised 12-1-87

M-2233-S

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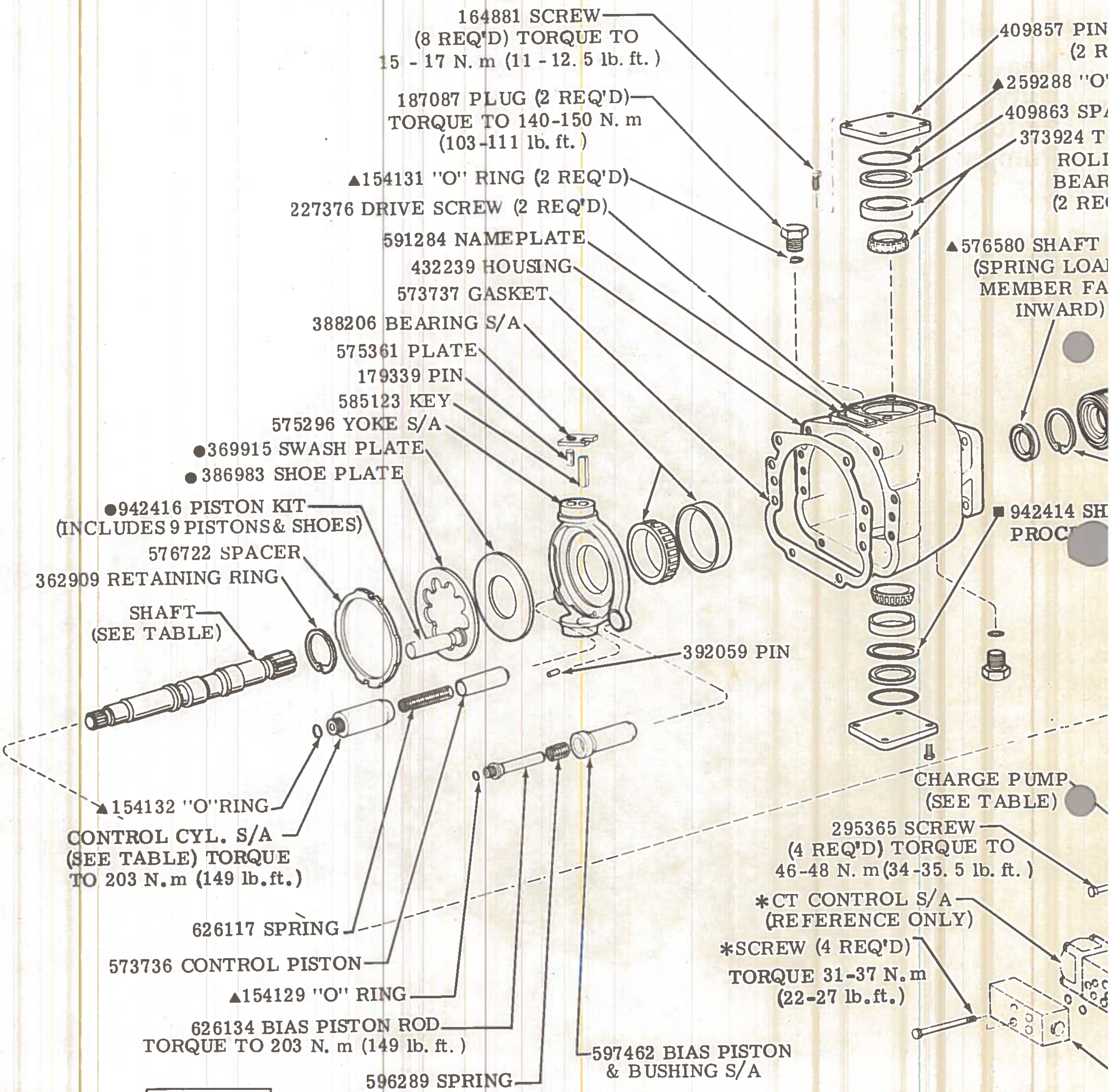
CONTROL TYPE	CONTROL CYL. S/A
C/CT/CTS	577590
CV/CN/N	412957

MODEL	SHAFT	KEY	NUT	TYPE
PVD45*-1*-22	581892	——	——	SPLINED
PVD45*-6*-22	576338			
PVD45*-10*-22	586142			
PVD45*-13*-22	578954	593088	290846	KEYED

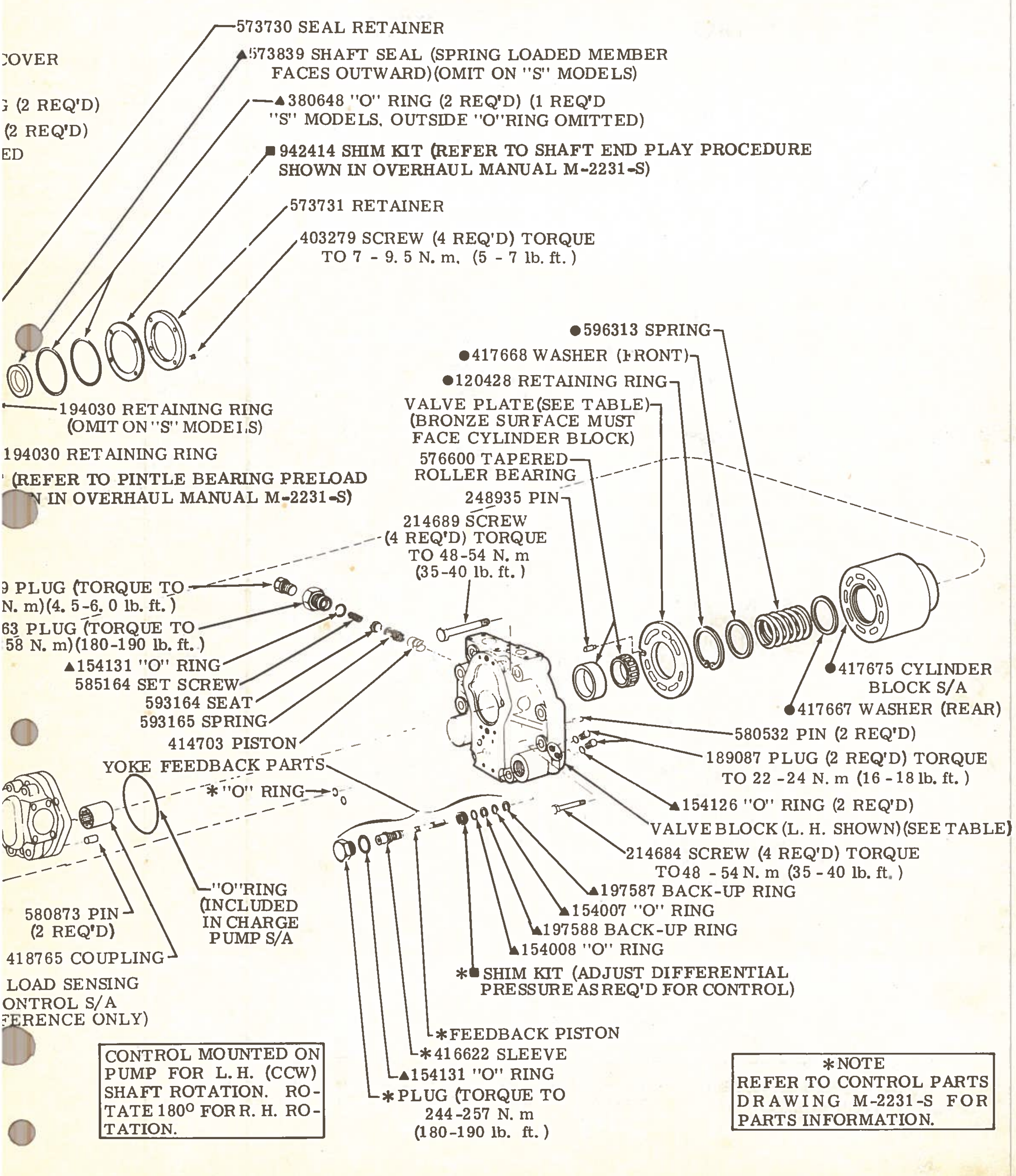


■SHIM KIT COMPLETE

▲INCLUDED IN 920092 SEAL KIT

●INCLUDED IN 938076 ROTATING GROUP KIT

MODEL	VALVE BLOCK	VALVE PLATE	CHARGE PUMP S/A	ROTATION DIRECTION	YOKE FEEDBACK FEATURE
PVD45R	581084	581055	926400	RIGHT	INCLUDED
PVD45R-C	581119				OMITTED
PVD45R-N	588967				INCLUDED
PVD45L	576714	573733	926399	LEFT	
PVD45L-C	581057				OMITTED
PVD45L-N	588966				INCLUDED


573730 SEAL RETAINER
COVER
▲573839 SHAFT SEAL (SPRING LOADED MEMBER FACES OUTWARD)(OMIT ON "S" MODELS)
G (2 REQ'D)
▲380648 "O" RING (2 REQ'D) (1 REQ'D "S" MODELS. OUTSIDE "O"RING OMITTED)
(2 REQ'D)
ED
■942414 SHIM KIT (REFER TO SHAFT END PLAY PROCEDURE SHOWN IN OVERHAUL MANUAL M-2231-S)
573731 RETAINER
403279 SCREW (4 REQ'D) TORQUE TO 7 - 9.5 N.m. (5 - 7 lb. ft.)
194030 RETAINING RING (OMIT ON "S" MODELS)
194030 RETAINING RING
(REFER TO PINTLE BEARING PRELOAD
N IN OVERHAUL MANUAL M-2231-S)
●596313 SPRING
●417668 WASHER (FRONT)
●120428 RETAINING RING
VALVE PLATE (SEE TABLE) (BRONZE SURFACE MUST FACE CYLINDER BLOCK)
576600 TAPERED ROLLER BEARING
248935 PIN
214689 SCREW (4 REQ'D) TORQUE TO 48-54 N.m (35-40 lb. ft.)
9 PLUG (TORQUE TO
N. m)(4.5-6.0 lb. ft.)
63 PLUG (TORQUE TO
58 N. m)(180-190 lb. ft.)
▲154131 "O" RING
585164 SET SCREW
593164 SEAT
593165 SPRING
414703 PISTON
YOKE FEEDBACK PARTS
*"O" RING
●417675 CYLINDER BLOCK S/A
●417667 WASHER (REAR)
580532 PIN (2 REQ'D)
189087 PLUG (2 REQ'D) TORQUE TO 22-24 N.m (16-18 lb. ft.)
▲154126 "O" RING (2 REQ'D)
VALVE BLOCK (L. H. SHOWN)(SEE TABLE)
214684 SCREW (4 REQ'D) TORQUE TO 48 - 54 N.m (35 - 40 lb. ft.)
▲197587 BACK-UP RING
▲154007 "O" RING
▲197588 BACK-UP RING
▲154008 "O" RING
*■SHIM KIT (ADJUST DIFFERENTIAL PRESSURE AS REQ'D FOR CONTROL)
"O"RING (INCLUDED IN CHARGE PUMP S/A
580873 PIN (2 REQ'D)
418765 COUPLING
LOAD SENSING
ONTROL S/A
FERENCE ONLY)
*FEEDBACK PISTON
*416622 SLEEVE
▲154131 "O" RING
*PLUG (TORQUE TO 244-257 N.m (180-190 lb. ft.)

CONTROL MOUNTED ON PUMP FOR L.H. (CCW) SHAFT ROTATION. ROTATE 180° FOR R. H. ROTATION.

*NOTE
REFER TO CONTROL PARTS DRAWING M-2231-S FOR PARTS INFORMATION.

MODEL CODE BREAKDOWN

P V D 45 C (01) * - * * - 22 - * ** ** ** * - 1*

PUMP

VARIABLE

INLINE SERIES D

FLOW RATING IN USGPM
(AT 1800 RPM)
45 - 45 USGPM

PACKAGING OPTIONS
C - CHARGE PUMP

SECONDARY FEATURE
01 - CHARGE OUTLET
TO PISTON INLET
TUBING

SHAFT ROTATION
(VIEWED FROM SHAFT END)
R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

SHAFT
1 - SPLINED
6 - SPLINED
10 - SPLINED
13 - KEYED

SHAFT SEAL
S - SINGLE
D - DOUBLE

PUMP DESIGN

REFER TO
CONTROL
DESIGN IN
M-2231-S

CONTROL OPTIONS	
C	CN
CD	CNS1
CT	CNS2
CTS	CVN
CV	CVNS1
CVT	CVNS2
CVTS	N

CONTROL DEFINITIONS
- C - PRESSURE LIMITER
- D - DUAL PRESS. LIMITER
- N - SPEED SENSING
- S - SUMMATION
- S1 - SUMMATION-MASTER PUMP SPEED SENSING
- S2 - SUMMATION-SLAVE PUMP SPEED SENSING
- T - TORQUE LIMITER
- V - LOAD SENSING

NOTE

Two digits will appear following an adjustable control function. This indicates control function pressure setting in bar/10. On speed sensing units (N), the two digits indicate RPM/100.

Ex. C 35 T 21 S
Pressure in bar/10

C 30 N 24 S1
RPM/100
Pressure in bar/10

S1 - Master pump in a speed sensing control
S2 - A slave pump.

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

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Service Parts Information

HEAVY DUTY PISTON PUMP

PVD45C-*-**-23-C**-13

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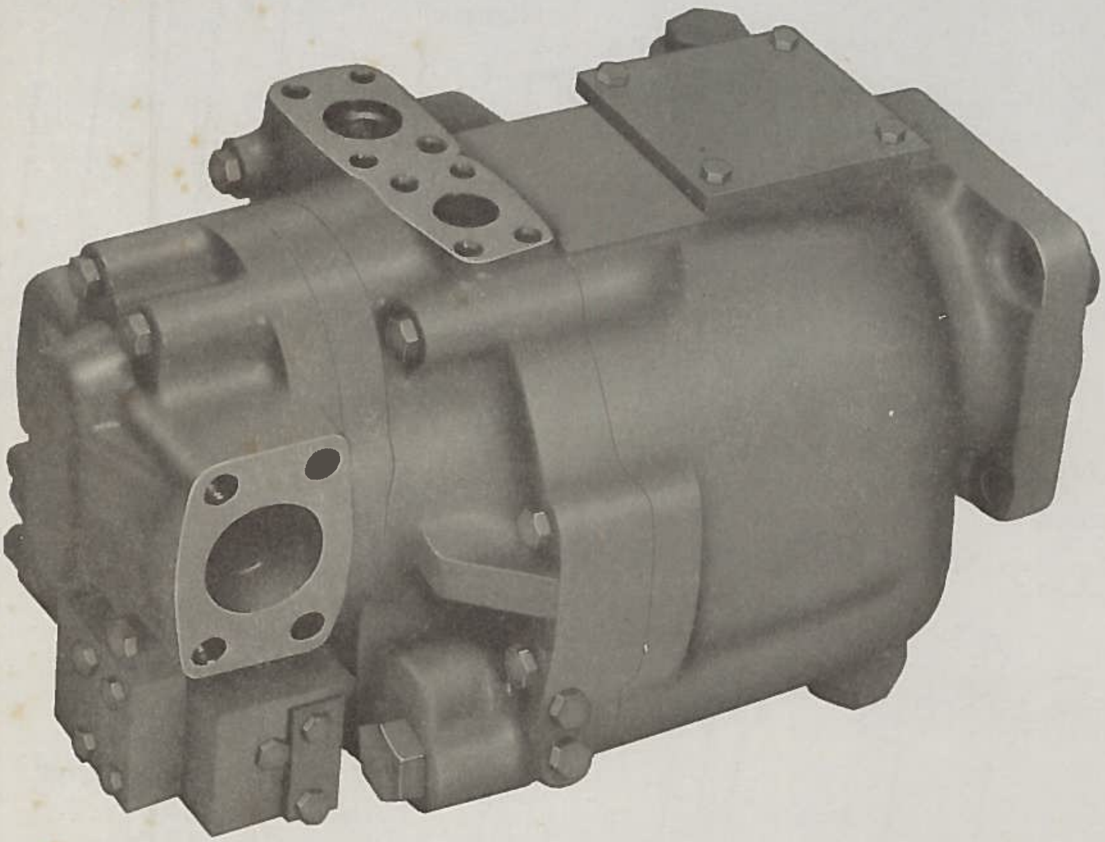

Vickers, Incorporated

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Released 2-1-89 **M-2239-S**

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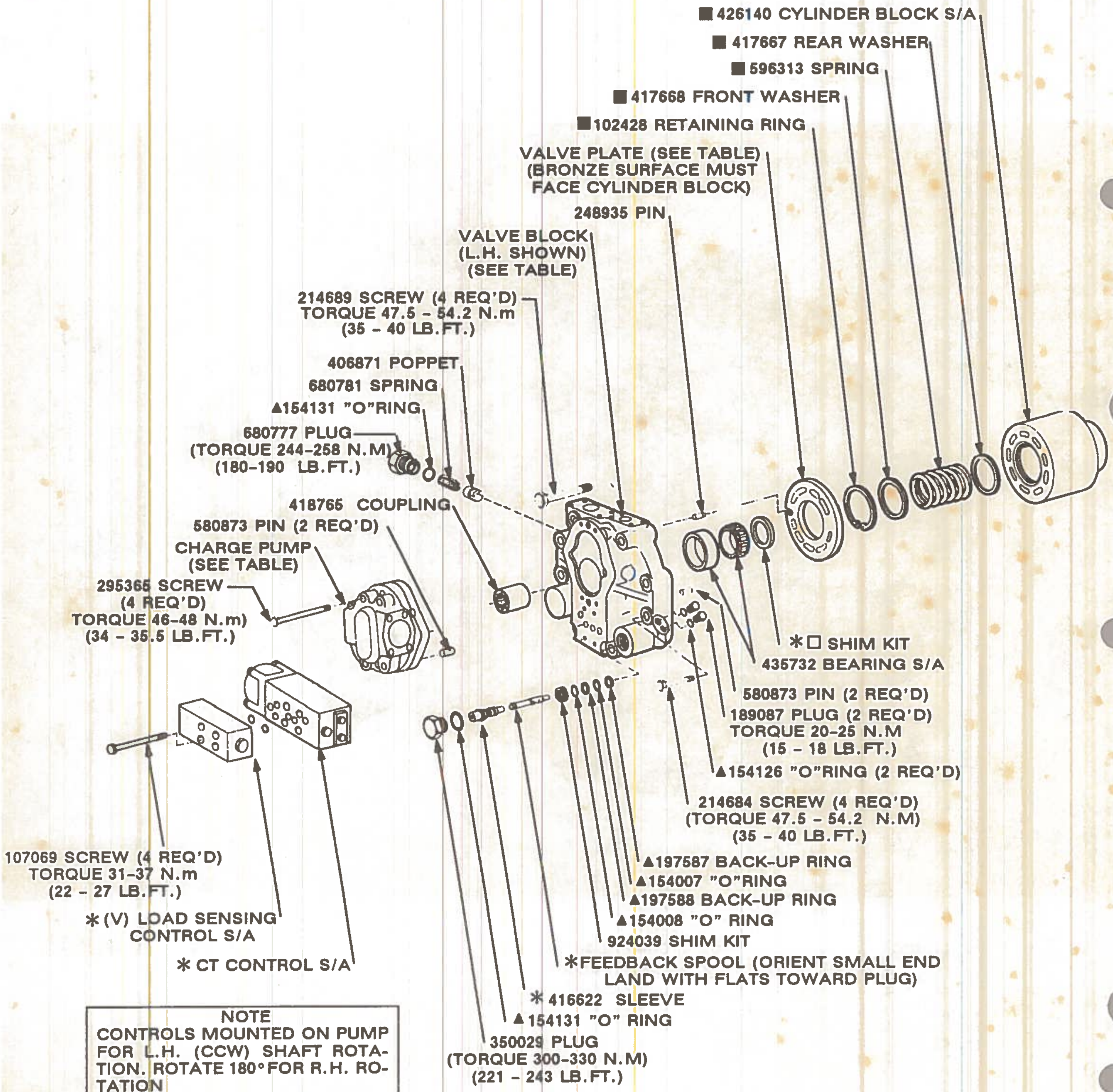
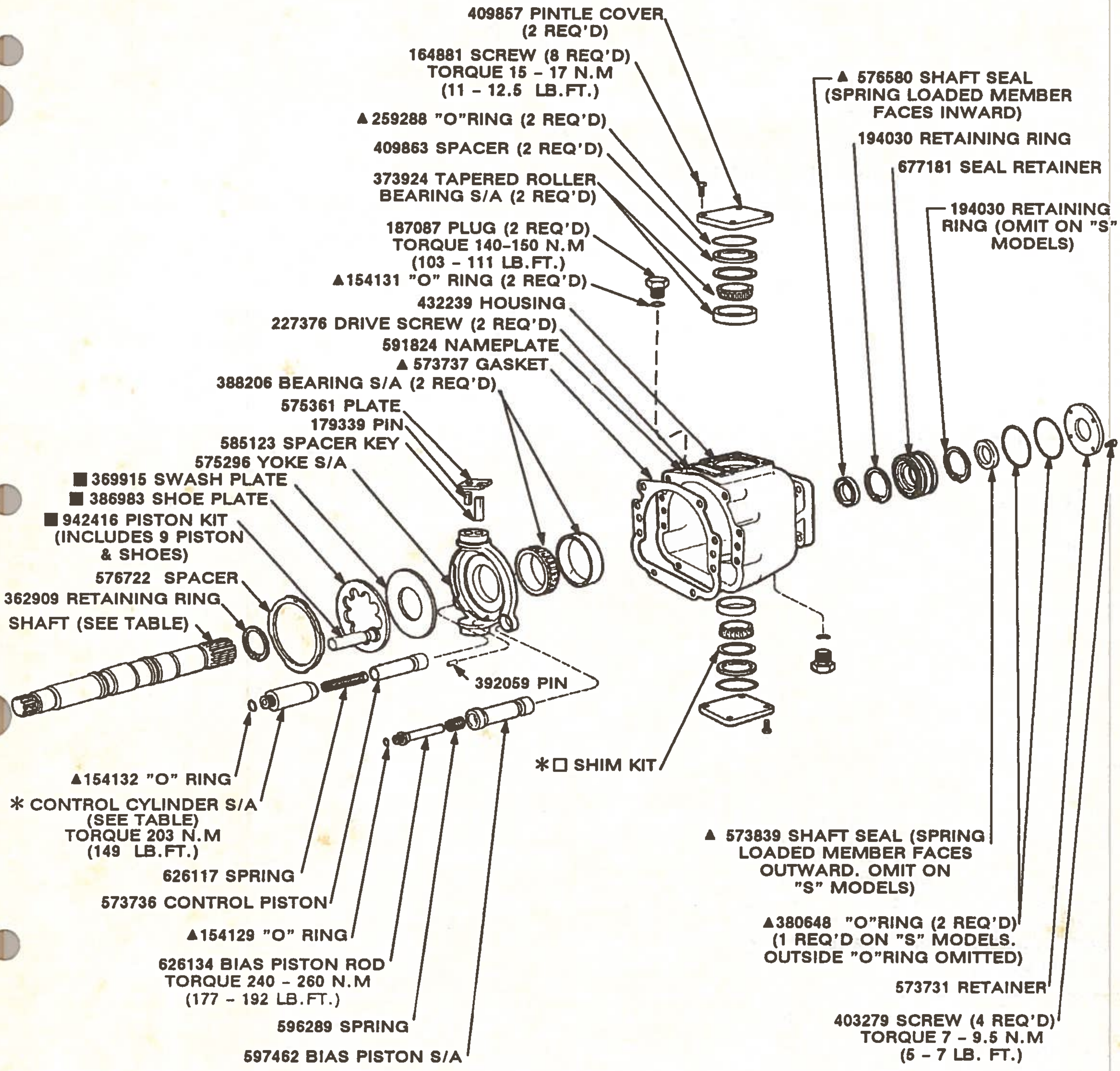
MODEL	CONTROL TYPE	VALVE BLOCK	VALVE PLATE	CHARGE PUMP KIT	ROTATION DIRECTION
PVD45R-C-T	TORQUE LIMIT, SUMMATION	677213	581550	926400	RIGHT
PVD45R-C-(V)	PRESS. COMP./LOAD SENSE	677214			
PVD45R-N	SPEED SENSE	677215			
PVD45L-C-T	TORQUE LIMIT, SUMMATION	677216	573733	926399	LEFT
PVD45L-C-(V)	PRESS. COMP./LOAD SENSE	677217			
PVD45L-N	SPEED SENSE	677218			


■ 426140 CYLINDER BLOCK S/A
■ 417667 REAR WASHER
■ 596313 SPRING
■ 417668 FRONT WASHER
■ 102428 RETAINING RING
VALVE PLATE (SEE TABLE) (BRONZE SURFACE MUST FACE CYLINDER BLOCK)
248935 PIN
VALVE BLOCK (L.H. SHOWN) (SEE TABLE)
214689 SCREW (4 REQ'D) TORQUE 47.5 - 54.2 N.m (35 - 40 LB.FT.)
406871 POPPET
680781 SPRING
▲154131 "O"RING
680777 PLUG (TORQUE 244-258 N.M) (180-190 LB.FT.)
418765 COUPLING
580873 PIN (2 REQ'D)
CHARGE PUMP (SEE TABLE)
295365 SCREW (4 REQ'D) TORQUE 46-48 N.m) (34 - 35.5 LB.FT.)
✱□ SHIM KIT
435732 BEARING S/A
580873 PIN (2 REQ'D)
189087 PLUG (2 REQ'D) TORQUE 20-25 N.M (15 - 18 LB.FT.)
▲154126 "O"RING (2 REQ'D)
214684 SCREW (4 REQ'D) (TORQUE 47.5 - 54.2 N.M) (35 - 40 LB.FT.)
▲197587 BACK-UP RING
▲154007 "O"RING
▲197588 BACK-UP RING
▲154008 "O" RING
924039 SHIM KIT
✱FEEDBACK SPOOL (ORIENT SMALL END LAND WITH FLATS TOWARD PLUG)
✱ 416622 SLEEVE
▲154131 "O" RING
350029 PLUG (TORQUE 300-330 N.M) (221 - 243 LB.FT.)
107069 SCREW (4 REQ'D) TORQUE 31-37 N.m (22 - 27 LB.FT.)
✱(V) LOAD SENSING CONTROL S/A
✱ CT CONTROL S/A

NOTE
CONTROLS MOUNTED ON PUMP FOR L.H. (CCW) SHAFT ROTATION. ROTATE 180° FOR R.H. ROTATION


409857 PINTLE COVER (2 REQ'D)
164881 SCREW (8 REQ'D) TORQUE 15 - 17 N.M (11 - 12.5 LB.FT.)
▲259288 "O"RING (2 REQ'D)
409863 SPACER (2 REQ'D)
373924 TAPERED ROLLER BEARING S/A (2 REQ'D)
187087 PLUG (2 REQ'D) TORQUE 140-150 N.M (103 - 111 LB.FT.)
▲154131 "O" RING (2 REQ'D)
432239 HOUSING
227376 DRIVE SCREW (2 REQ'D)
591824 NAMEPLATE
▲ 573737 GASKET
388206 BEARING S/A (2 REQ'D)
575361 PLATE
179339 PIN
585123 SPACER KEY
575296 YOKE S/A
■ 369915 SWASH PLATE
■ 386983 SHOE PLATE
■ 942416 PISTON KIT (INCLUDES 9 PISTON & SHOES)
576722 SPACER
362909 RETAINING RING
SHAFT (SEE TABLE)
392059 PIN
▲154132 "O" RING
✻ CONTROL CYLINDER S/A (SEE TABLE) TORQUE 203 N.M (149 LB.FT.)
626117 SPRING
573736 CONTROL PISTON
▲154129 "O" RING
626134 BIAS PISTON ROD TORQUE 240 - 260 N.M (177 - 192 LB.FT.)
596289 SPRING
597462 BIAS PISTON S/A
✻□ SHIM KIT
▲ 576580 SHAFT SEAL (SPRING LOADED MEMBER FACES INWARD)
194030 RETAINING RING
677181 SEAL RETAINER
194030 RETAINING RING (OMIT ON "S" MODELS)
▲ 573839 SHAFT SEAL (SPRING LOADED MEMBER FACES OUTWARD. OMIT ON "S" MODELS)
▲380648 "O"RING (2 REQ'D) (1 REQ'D ON "S" MODELS. OUTSIDE "O"RING OMITTED)
573731 RETAINER
403279 SCREW (4 REQ'D) TORQUE 7 - 9.5 N.M (5 - 7 LB. FT.)

MODEL	SHAFT	KEY	NUT	TYPE
PVD45*-1	677168	———	———	SPLINED
PVD45*-2	677197	593088		
PVD45*-6	677198	———		
PVD45*-10	677199			
PVD45*-13	677200	593088	290846	KEYED
PVD45*-14	677201	———	———	SPLINED

CONTROL TYPE	CONTROL CYL. S/A
C/CT/CTS	577590
CV/CN/N	412957

✻ NOTE
REFER TO OVERHAUL MANUAL M-2231-S FOR CONTROL INFORMATION, FEEDBACK SPOOL & SLEEVE NUMBERS AND CHARGE RELIEF PROCEDURE.

▲ INCLUDED IN SEAL KIT 920092
□ INCLUDED IN 924037 SHIM KIT
■ INCLUDED IN 938076 ROTATING GROUP

MODEL CODE BREAKDOWN

P V D 45 C * - * * - 23 - C** -13

1	2	3	4	5	6	7	8	9	10	11

1 PISTON PUMP

2 VARIABLE DISPLACEMENT

3 D SERIES INLINE

4 FLOW RATING IN USGPM AT 1800 RPM

45 - 45 USGPM

5 PACKAGING OPTIONS

C - CHARGE PUMP

6 SHAFT ROTATION (Viewed from shaft end)

R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

7 SHAFT

1 - SPLINED
2 - KEYED
6 - SPLINED
10 - SPLINED
13 - KEYED
14 - SPLINED

8 SHAFT SEAL

S - SINGLE
D - DOUBLE

9 PUMP DESIGN

10 CONTROL OPTIONS & DEFINITIONS

C	PRESSURE LIMITER
CT	TORQUE CONTROL WITH PRESSURE LIMITER
CTS	SUMMATION TORQUE CONTROL WITH PRESSURE LIMITER
CV	LOAD SENSING WITH PRESSURE LIMITER
CVT	LOAD SENSING WITH TORQUE
CVTS	LOAD SENSING WITH SUMMATION TORQUE AND PRESSURE LIMITER

NOTE
TWO DIGITS WILL APPEAR FOLLOWING AN ADJUSTABLE CONTROL FUNCTION PRESSURE SETTING IN BAR/10.

Example:
C35T21S
PRESSURE IN BAR/10

11 CONTROL DESIGN

SHAFT END PLAY SHIMMING PROCEDURE

1. INSTALL BEARING S/A ON END OF SHAFT WITHOUT SHIM. INSTALL VALVE BLOCK ON HOUSING AND SECURE WITH SEVEN SCREWS.
2. ROTATE THE SHAFT. APPLY 1110-1330 N.m (250-299 LBF) FORCE AT END OF SHAFT TO SEAT SHAFT BEARING.
3. MEASURE SHAFT END PLAY WITH A DIAL INDICATOR.
4. REMOVE VALVE BLOCK AND BEARING S/A FROM UNIT. INSTALL SHIMS TO END OF SHAFT TO PROVIDE .025-.102 MM (.001-.004 INCH) SHAFT END PLAY.
5. INSTALL BEARING S/A ON END OF SHAFT. INSTALL THE VALVE BLOCK AND SECURE WITH SEVEN SCREWS.
6. REPEAT STEP 3.

PINTLE BEARING PRELOAD SHIMMING PROCEDURE

1. INSTALL BOTH PINTLE BEARING COVERS ON THE YOKE S/.A
2. INSTALL COMPLETE PINTLE ASSEMBLY (INCLUDES BEARING RACE, SPACER, 'O'RING, PINTLE COVER AND SLEEVES) AT TOP OF HOUSING.
3. INSTALL THE OTHER BEARING RACE. INSTALL SHIM. (APPROXIMATELY .40 MM) AND SPACER SO THAT THE SPACER PROTRUDES .25-MM (.001 - .015 INCH) ABOVE THE HOUSING FACE.
4. MOVE THE YOKE S/A BACK AND FORTH. APPLY 1110-1330 N (250-299 LBF) FORCE TO THE SPACER TO SEAT THE PINTLE BEARINGS.
5. MEASURE THE DISTANCE FROM FACE OF HOUSING TO THE TOP OF SPACER.
6. REMOVE THE SPACER. REMOVE THE AMOUNT OF SHIMS EQUAL TO THE MEASUREMENT FOUND IN STEP 5.
7. ADD .381 - .483 MM (.015-.019 INCH) SHIM THICKNESS TO THE SHIM STACK FOUND IN STEP 6. ASSEMBLE THE SPACER.
8. INSTALL 'O'RING, PINTLE COVER AND SCREWS TO COMPLETE THE PINTLE ASSEMBLY.

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

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Service Parts Information

Heavy Duty Piston Pump

PVE27*-E2-21-C**-20

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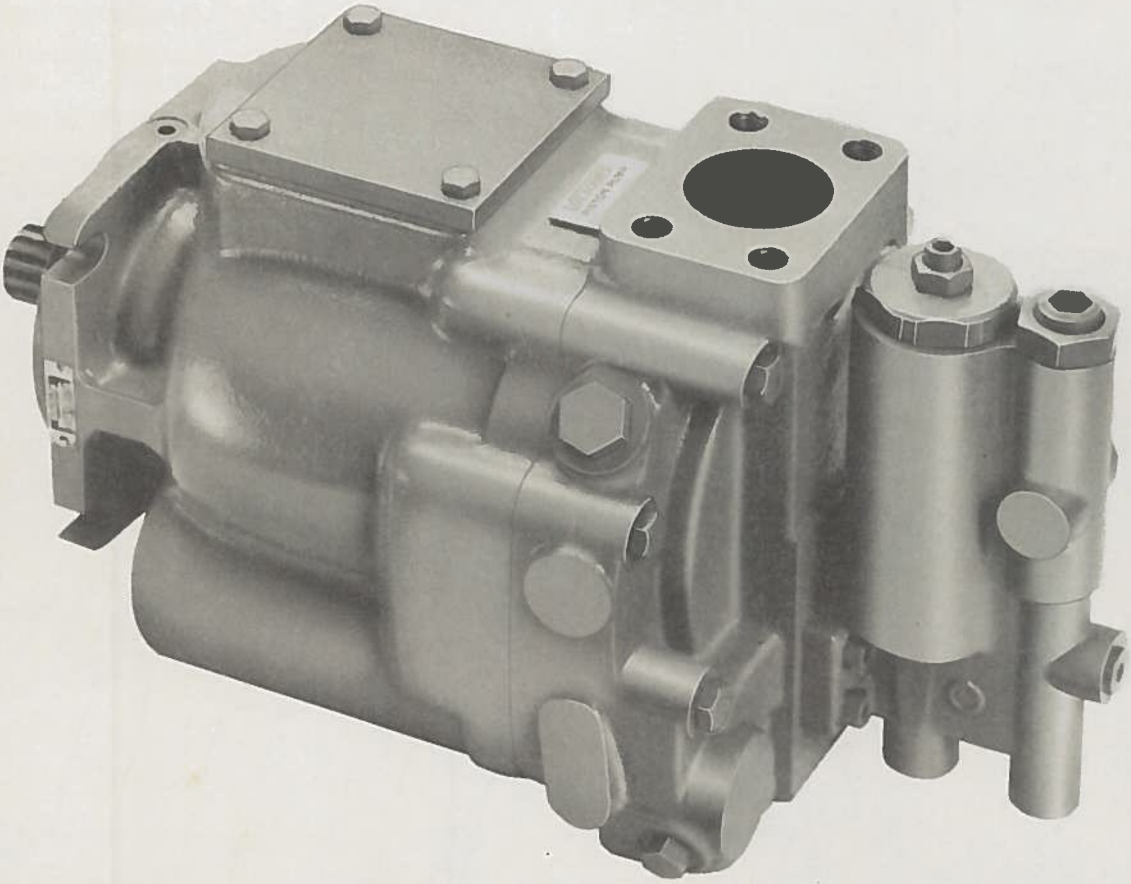

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Revised 1-1-88

M-2241-S

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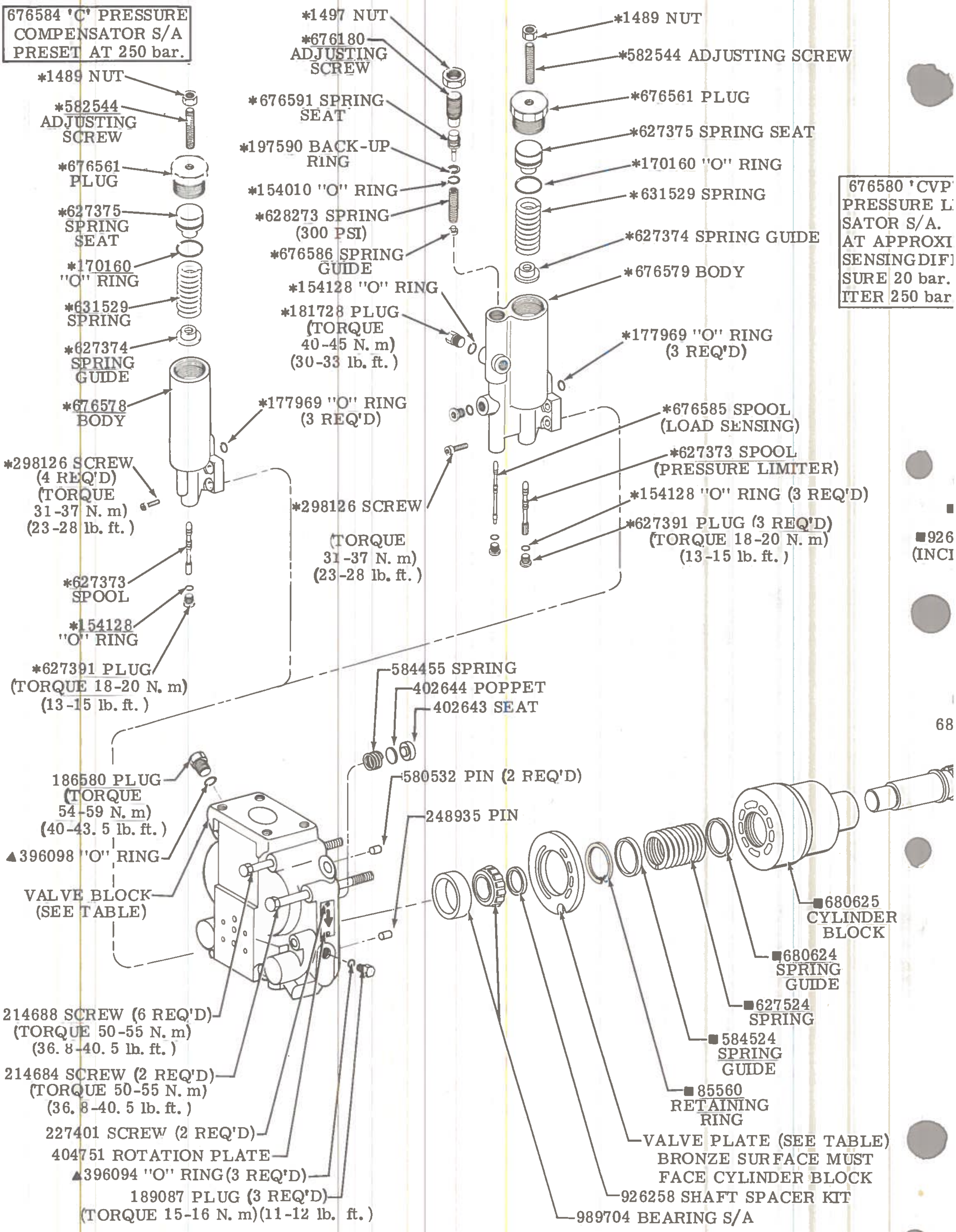
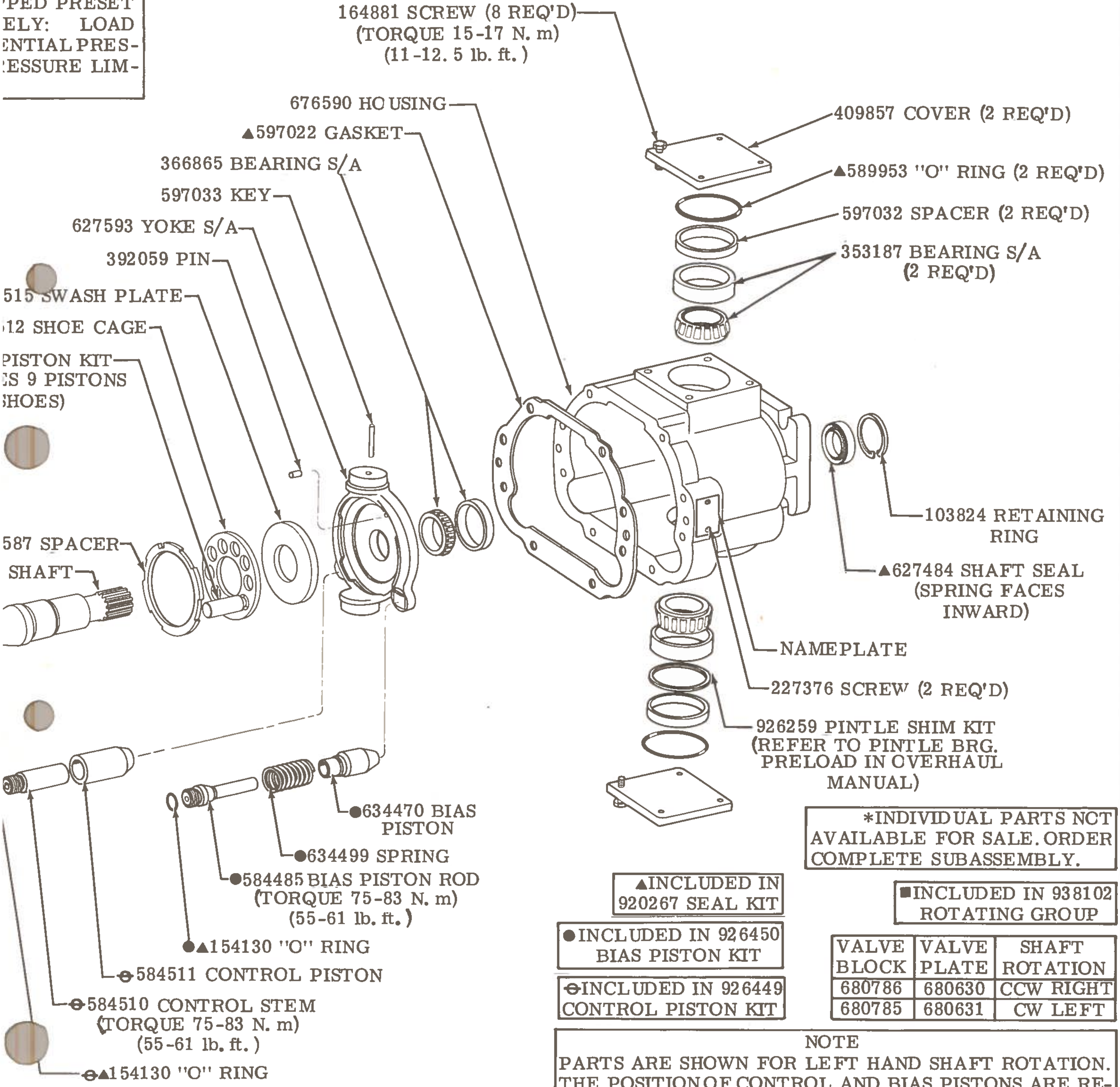

676584 'C' PRESSURE COMPENSATOR S/A PRESET AT 250 bar.
*1489 NUT
*582544 ADJUSTING SCREW
*676561 PLUG
*627375 SPRING SEAT
*170160 "O" RING
*631529 SPRING
*627374 SPRING GUIDE
*676578 BODY
*298126 SCREW (4 REQ'D) (TORQUE 31-37 N. m) (23-28 lb. ft.)
*627373 SPOOL
*154128 "O" RING
*627391 PLUG (TORQUE 18-20 N. m) (13-15 lb. ft.)
*1497 NUT
*676180 ADJUSTING SCREW
*676591 SPRING SEAT
*197590 BACK-UP RING
*154010 "O" RING
*628273 SPRING (300 PSI)
*676586 SPRING GUIDE
*154128 "O" RING
*181728 PLUG (TORQUE 40-45 N. m) (30-33 lb. ft.)
*177969 "O" RING (3 REQ'D)
*298126 SCREW
(TORQUE 31-37 N. m) (23-28 lb. ft.)
*1489 NUT
*582544 ADJUSTING SCREW
*676561 PLUG
*627375 SPRING SEAT
*170160 "O" RING
*631529 SPRING
*627374 SPRING GUIDE
*676579 BODY
*177969 "O" RING (3 REQ'D)
*676585 SPOOL (LOAD SENSING)
*627373 SPOOL (PRESSURE LIMITER)
*154128 "O" RING (3 REQ'D)
*627391 PLUG (3 REQ'D) (TORQUE 18-20 N. m) (13-15 lb. ft.)
676580 'CVP
PRESSURE L
SATOR S/A.
AT APPROXI
SENSING DIFI
SURE 20 bar.
ITER 250 bar
■
■926
(INCI
68
584455 SPRING
402644 POPPET
402643 SEAT
580532 PIN (2 REQ'D)
248935 PIN
186580 PLUG (TORQUE 54-59 N. m) (40-43. 5 lb. ft.)
▲396098 "O" RING
VALVE BLOCK (SEE TABLE)
214688 SCREW (6 REQ'D) (TORQUE 50-55 N. m) (36. 8-40. 5 lb. ft.)
214684 SCREW (2 REQ'D) (TORQUE 50-55 N. m) (36. 8-40. 5 lb. ft.)
227401 SCREW (2 REQ'D)
404751 ROTATION PLATE
▲396094 "O" RING (3 REQ'D)
189087 PLUG (3 REQ'D) (TORQUE 15-16 N. m) (11-12 lb. ft.)
■680625 CYLINDER BLOCK
■680624 SPRING GUIDE
■627524 SPRING
■584524 SPRING GUIDE
■85560 RETAINING RING
VALVE PLATE (SEE TABLE) BRONZE SURFACE MUST FACE CYLINDER BLOCK
926258 SHAFT SPACER KIT
989704 BEARING S/A

PVE27*-E2-21-C**-20

AD SENSING/
ER COMPEN-
PED PRESET
ELY: LOAD
NTIAL PRES-
ESSURE LIM-


164881 SCREW (8 REQ'D) (TORQUE 15-17 N. m) (11-12. 5 lb. ft.)
676590 HOUSING
▲597022 GASKET
366865 BEARING S/A
597033 KEY
627593 YOKE S/A
392059 PIN
515 SWASH PLATE
12 SHOE CAGE
PISTON KIT
ES 9 PISTONS
HOES)
587 SPACER
SHAFT
409857 COVER (2 REQ'D)
▲589953 "O" RING (2 REQ'D)
597032 SPACER (2 REQ'D)
353187 BEARING S/A (2 REQ'D)
103824 RETAINING RING
▲627484 SHAFT SEAL (SPRING FACES INWARD)
NAMEPLATE
227376 SCREW (2 REQ'D)
926259 PINTLE SHIM KIT (REFER TO PINTLE BRG. PRELOAD IN OVERHAUL MANUAL)
●634470 BIAS PISTON
●634499 SPRING
●584485 BIAS PISTON ROD (TORQUE 75-83 N. m) (55-61 lb. ft.)
●▲154130 "O" RING
⊖584511 CONTROL PISTON
⊖584510 CONTROL STEM (TORQUE 75-83 N. m) (55-61 lb. ft.)
⊖▲154130 "O" RING

*INDIVIDUAL PARTS NOT AVAILABLE FOR SALE. ORDER COMPLETE SUBASSEMBLY.

▲INCLUDED IN 920267 SEAL KIT

■INCLUDED IN 938102 ROTATING GROUP

●INCLUDED IN 926450 BIAS PISTON KIT

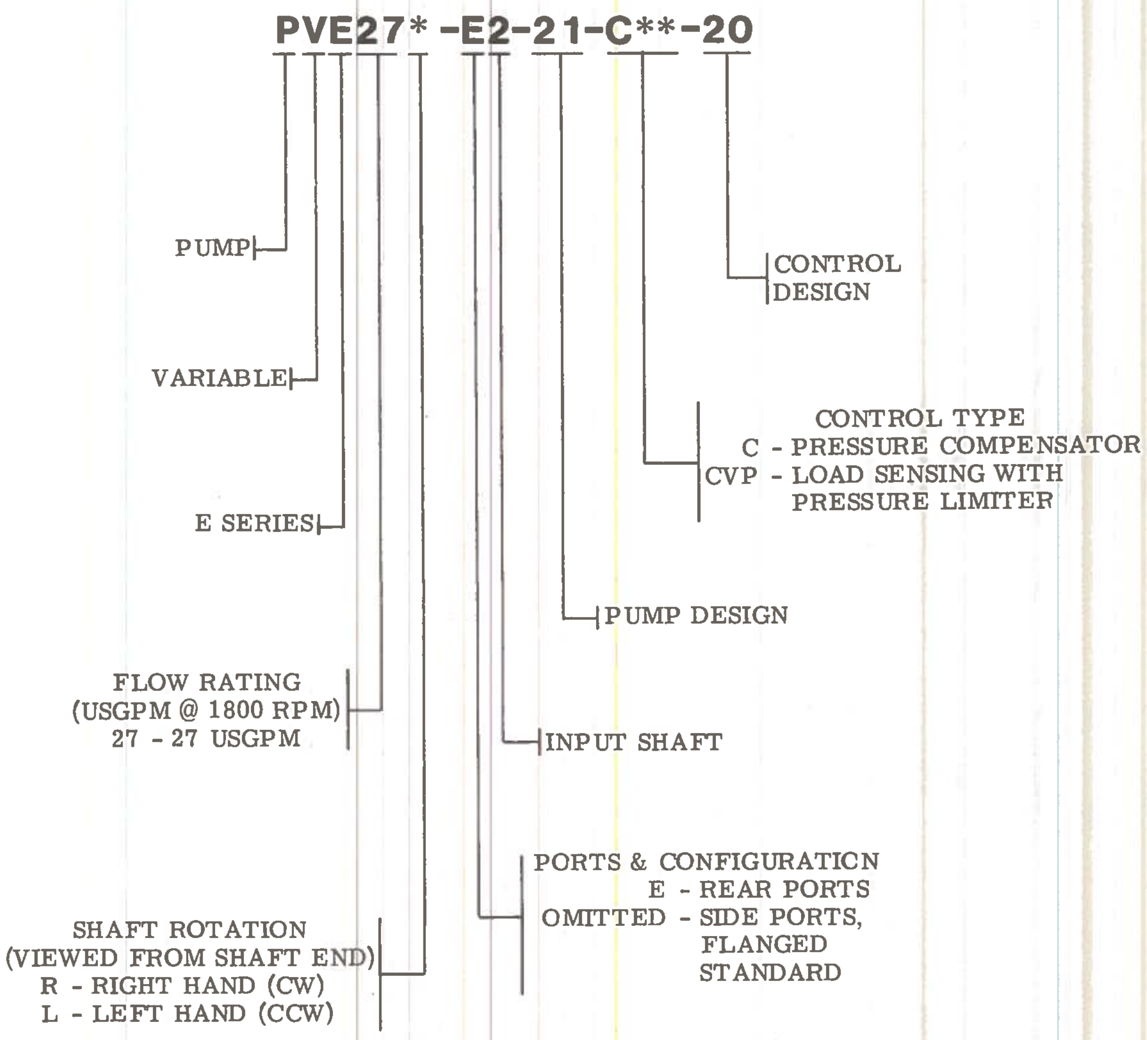
⊖INCLUDED IN 926449 CONTROL PISTON KIT

VALVE BLOCK	VALVE PLATE	SHAFT ROTATION
680786	680630	CCW RIGHT
680785	680631	CW LEFT

NOTE

PARTS ARE SHOWN FOR LEFT HAND SHAFT ROTATION. THE POSITION OF CONTROL AND BIAS PISTONS ARE REVERSED FOR RIGHT HAND ROTATION. (ASSEMBLE USING LOCTITE 270).

MODEL CODE BREAKDOWN



PVE27* -E2-21-C**-20

PUMP

VARIABLE

E SERIES

FLOW RATING
(USGPM @ 1800 RPM)
27 - 27 USGPM

SHAFT ROTATION
(VIEWED FROM SHAFT END)
R - RIGHT HAND (CW)
L - LEFT HAND (CCW)

CONTROL
DESIGN

CONTROL TYPE
C - PRESSURE COMPENSATOR
CVP - LOAD SENSING WITH
PRESSURE LIMITER

PUMP DESIGN

INPUT SHAFT

PORTS & CONFIGURATION
E - REAR PORTS
OMITTED - SIDE PORTS,
FLANGED
STANDARD

To insure sustained efficiency and maximum trouble free life of this precision equipment, initial and continuous full flow filtration of the inlet fluid medium is essential. Inlet fluid should meet ISO cleanliness code 19/15. Select and apply filters from the Vickers OFP, OFR, and OFRS series, which are available in 3, 10, and 25 micrometre filtration ratings.

Litho in U. S. A.

9

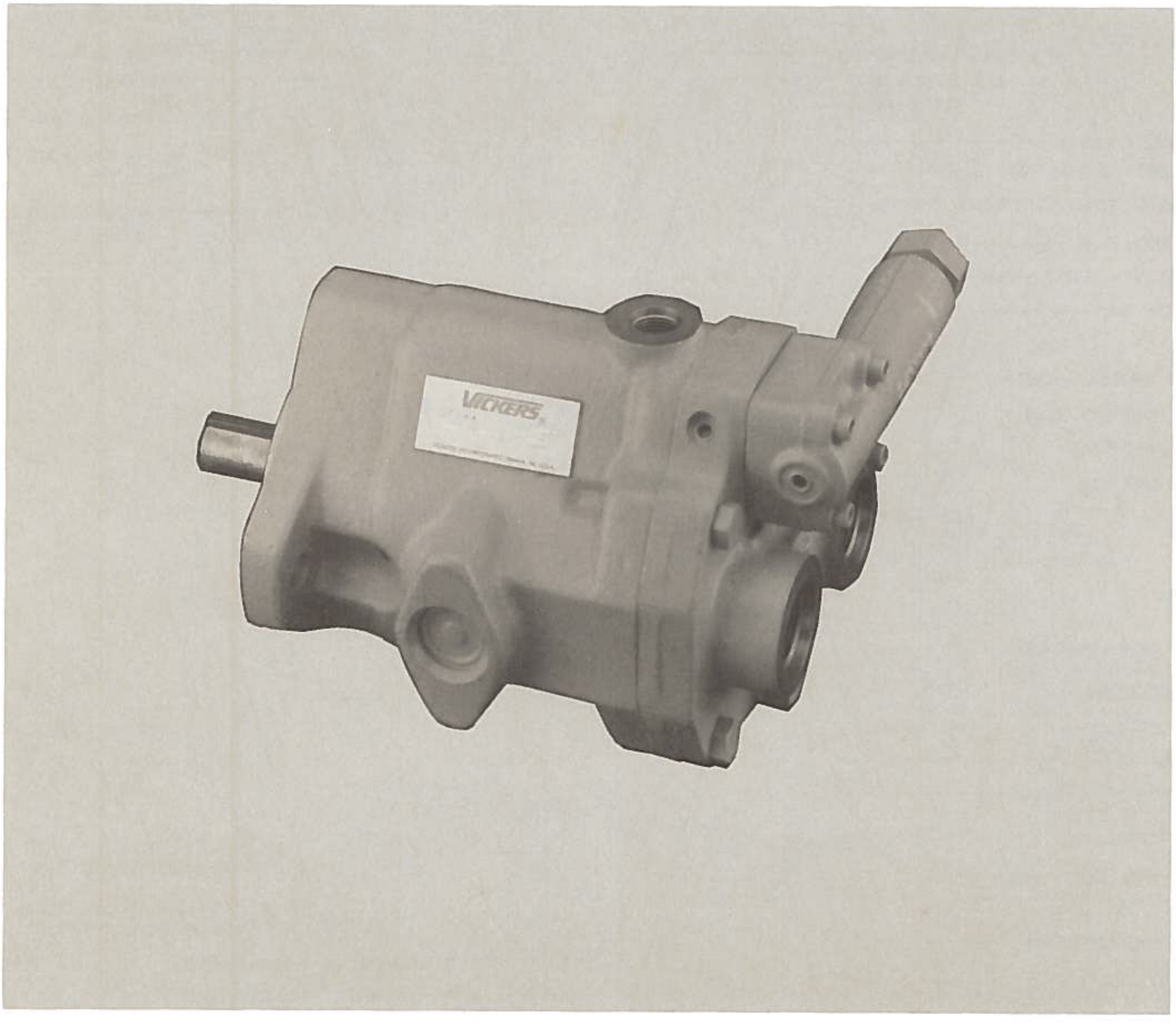
Service Data

VICKERS

Low Noise Industrial Piston Pump

58

PVQ 10–A2/MA * *** – ** * * – 10 C** *** *** * – 11/12/20
PVQ 13–A2/MA * *** – ** * * – 10 C** *** *** * – 11/12/20



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Released 09-01-91

▨ CAUTION

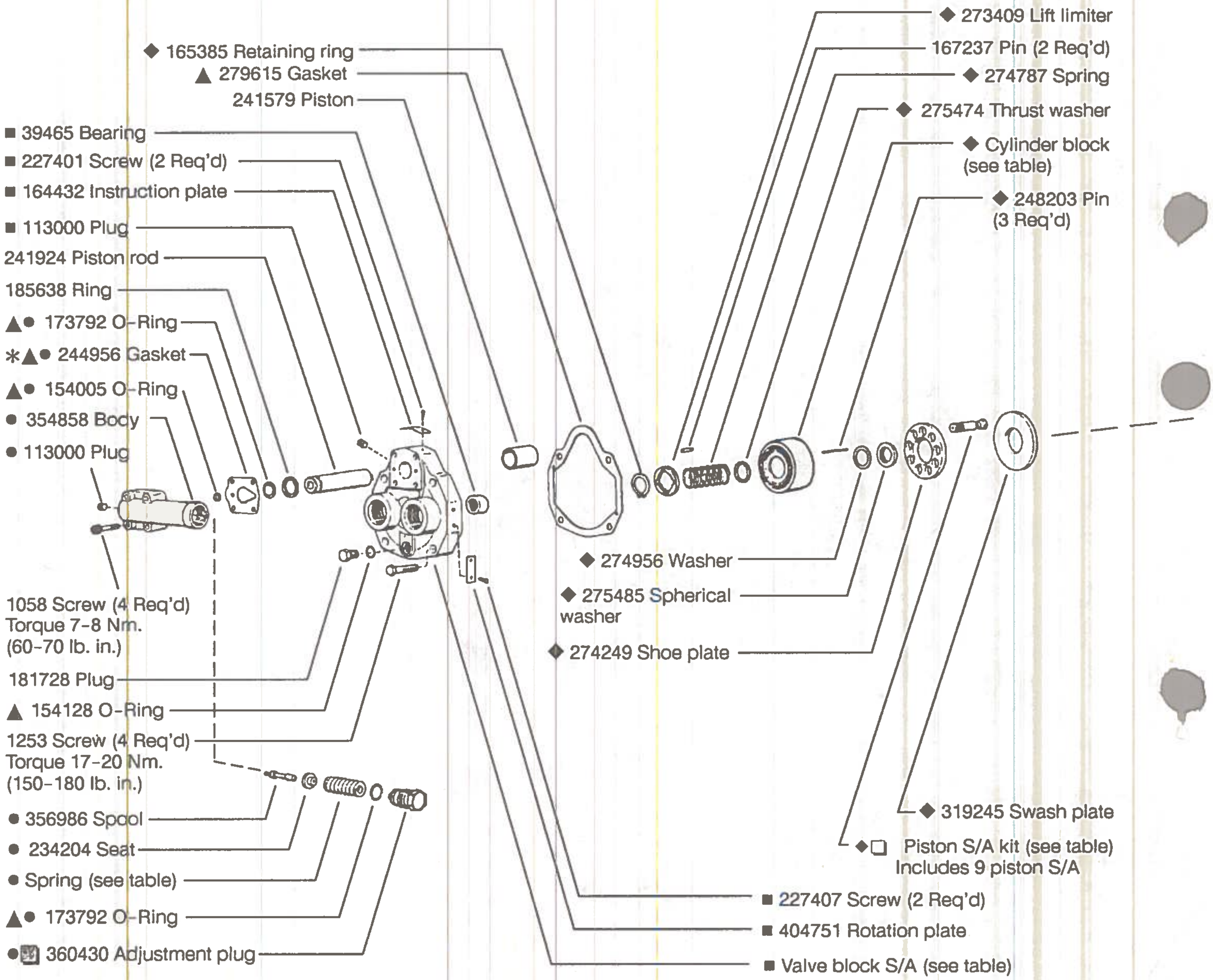
Model PVQ13C compensator pressure adjustment shall not exceed 2000 psi

Model	● Comp. kit	● Comp. Spring	● Load Sense Spring
PVQ**C	942158	239371	———
PVQ**CM	942159	265693	———
PVQ**CG	942480	239371	———
PVQ**FCG	941353	265693	———
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

NOTE:

C, CM Compensator shown for right hand rotation. Rotate 180° for left hand shaft rotation and connect to left hand valve block S/A.

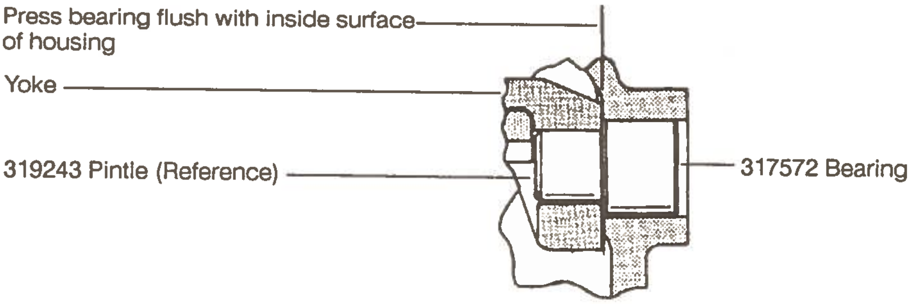
9 NOTE: See model code for pressure range settings of individual compensator kits.



✱ CAUTION

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

■ Valve block S/A	Right hand	Left hand
Rear ports	860757	860756
Side ports	860759	860758

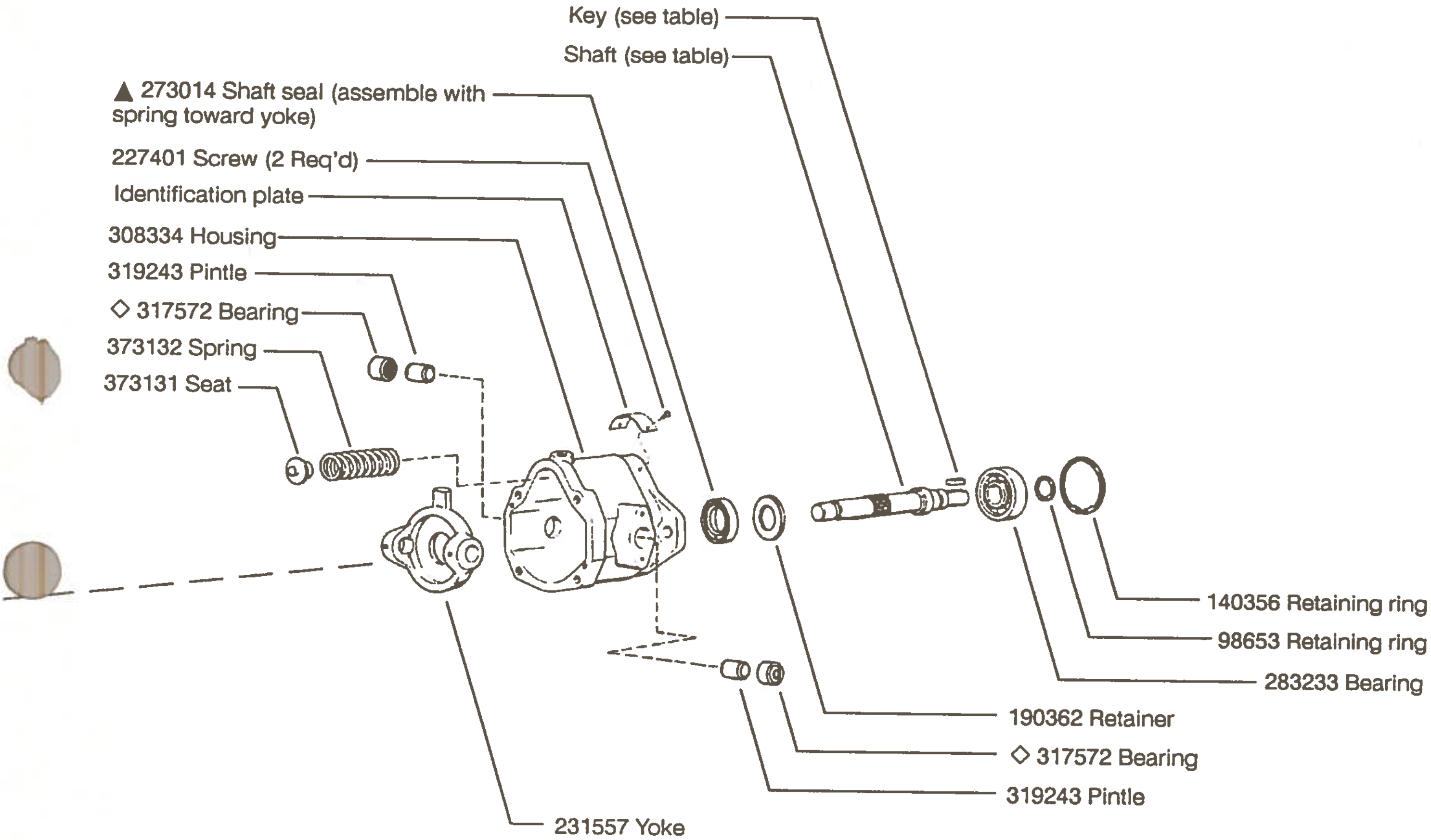

Press bearing flush with inside surface of housing
Yoke
319243 Pintle (Reference)
317572 Bearing

◇ PINTLE BEARING ASSEMBLY NOTE

The bearing O.D. surface and mating surface in the housing must be clean. Apply sealing compound (Loctite A (10-1) or equivalent) to the bearing O.D. and press in place.

CAUTION

Do not allow sealing compound to contact the bearing needles.



Model	Cylinder block	☐ Piston S/A kit	◆ Rotating group kit
PVQ10	274670	942229	938262
PVQ13	315148	942230	938264

Shaft	Type	Key
266162	1	142843
286848	3	—
883030	N	472255

NOTE:

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

▲ Standard seal kit 919191
F3 equivalent seal kit 919308
● Compensator kit (see table)
■ Valve block S/A (see table)
◆ Rotating group kit (see table)
☐ Piston S/A kit (see table)

Model Code

PVQ 1*–** * – ** * * – 10 C** *** *** * _ **

1 2 3 4 5 6 7 8 9 10 11

1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement
(CC/Rev & Pressure ratings)

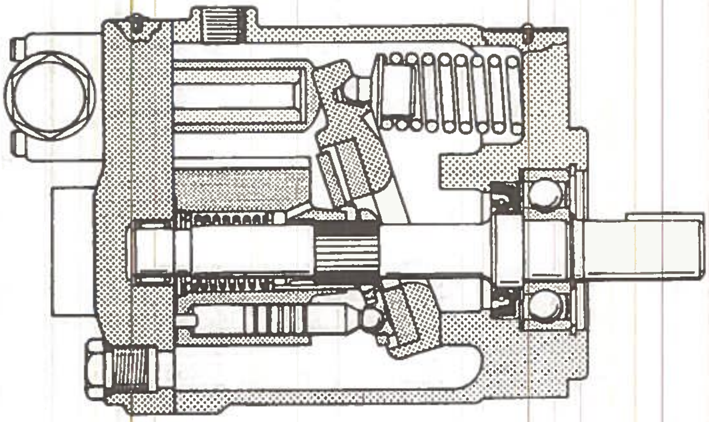
10 – 10 CC/Rev (.64 CIR)
210 bar (3000 psi)
13 – 13 CC/Rev (.84 CIR)
140 bar (2000 psi)

3 Mounting flange

A2 – SAE "A" 2-bolt
MA – ISO 3019/2 "A" 2-bolt (available with "N" driveshaft only)

4 Rotation
(viewed from shaft end)

R – Right hand (CW), (standard)
L – Left hand (CCW), (optional)



Typical sectional view

5 Ports
(type and location)

SE – O-Ring boss rear port, 1.0625 inch (Inlet & Outlet) (standard)
SS – O-Ring boss side port, 1.3125 inch (Inlet & Outlet) (optional)

6 Shafts
(input)

1 – Straight keyed SAE "A" modified .75 inch Dia. x 1.75 inch long
3 – Splined SAE "A" modified 9T, 16/32 DP major Dia. fit
N – ISO 3019/2 short straight keyed (available with "MA" mounting only)

7 Seals

S – Buna N (standard)
F – Fluorocarbon, (optional)

8 Pump design number

10 – First design

9 Control type

C** – Pressure compensator, PVQ10: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ13: Std. model is C14, indicating factory setting of 140 bar (2000 psi). Range is 02-14 in tens of bar (350-2000 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
CV**B** – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice.
Example: C21V11B indicates PVQ10 compensator with 210 bar pressure setting and 11 bar load sense differential.
CV**P** – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
CVC**B** – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
CVC**P** – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD** – Electric dual range compensator. PVQ10: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ13: Std. model is CD1407, indicating settings of 140 and 70 bar, adjustment ranges are 20-140 bar (high) and 20-100 bar (low).

10 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

11 Control design

11 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

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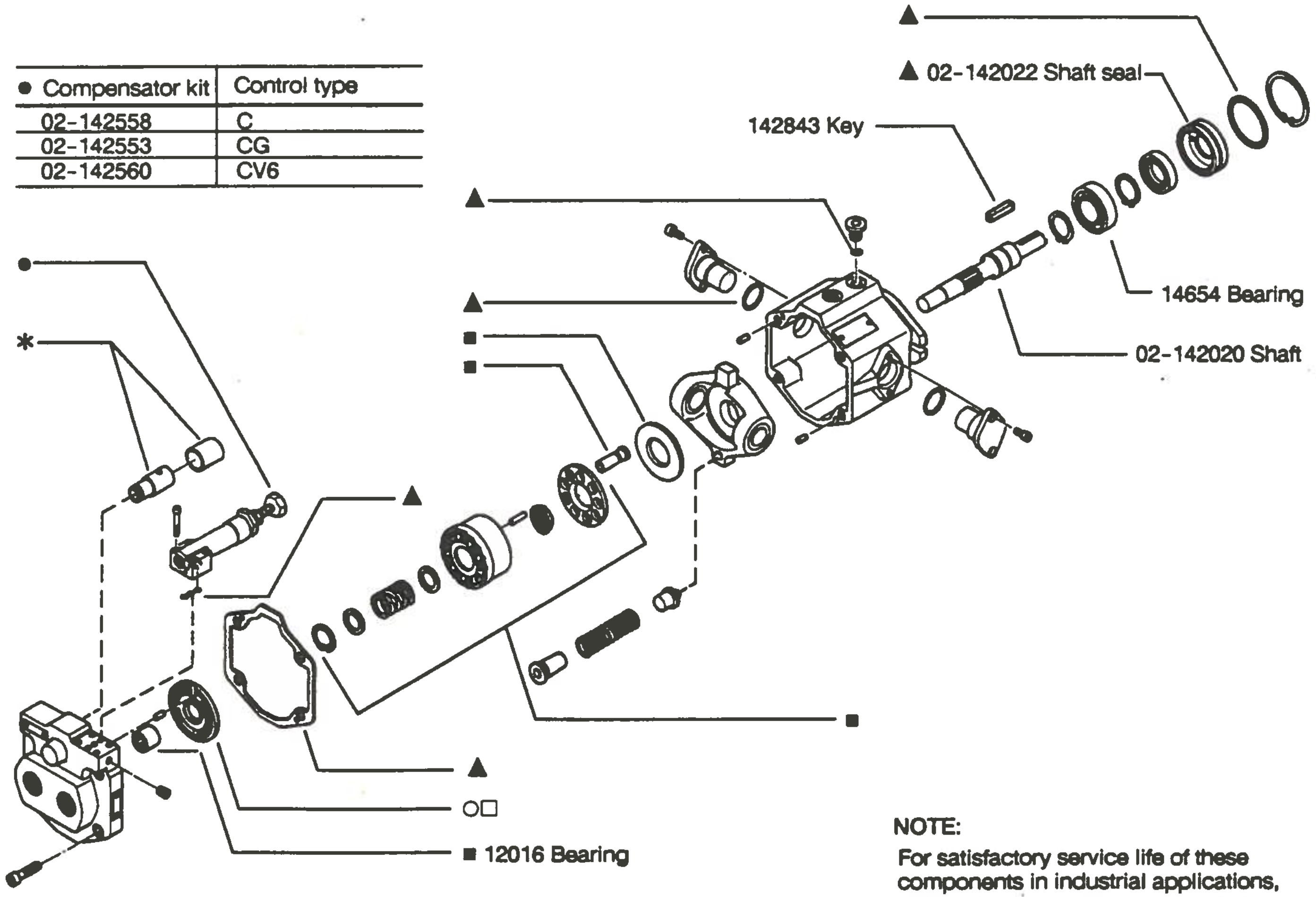
Service Parts Information

Low Noise Industrial Piston Pump

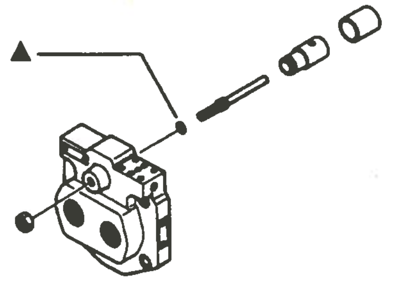
PVQ 16-A2* ***-** * *-11C ** *** *** *-12

● Compensator kit	Control type
02-142558	C
02-142553	CG
02-142560	CV6



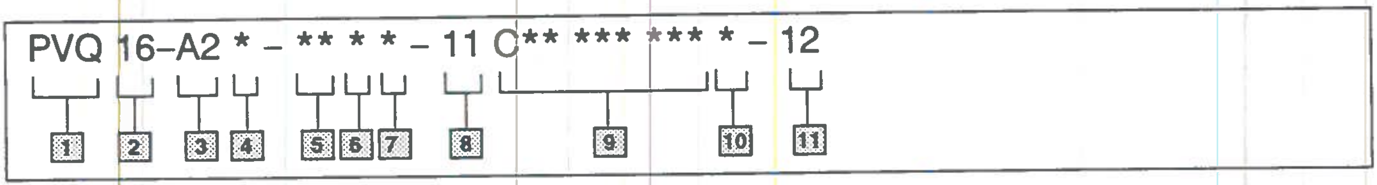
NOTE:
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

Maximun adjustable displacement option



■ Rotating Group	02-142016
● Compensator kit	(see table)
○ Wafer Plate (RH)	02-142019
☐ Wafer Plate (LH)	02-142018
▲ Seal Kit	02-142021
* Stroking Piston	02-142023

Model Code



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement

(CC/Rev & Pressure ratings)

16 – 16.0 CC/Rev (.976 CIR)
207 bar (3000 psi)

3 Mounting flange

A2 – SAE "A" 2-bolt

4 Rotation

(viewed from shaft end)

R – Right hand (CW)
L – Left hand (CCW)

5 Ports

(type and location)

SE – Inch O-Ring boss rear port

6 Shafts

(input)

1 – Straight keyed SAE "A"

7 Seals

(input shaft all types)

S – Buna N (standard)

8 Pump design number

11 – Design

9 Control type

C** – Pressure compensator, Std. setting 21 in tens of bar (max. setting 210 bar) 3000 psi
Range 02-21 in tens of bar
CG – Compensator for hydraulic remote control
CV6 – Load sensing, Std. load sensing setting is 6 bar (87 psi), without pressure compensation and no bleed down orifice.
NOTE: Relief valve required

10 Control option

D – Maximum adjustable stop

11 Control design

1* – Current design number

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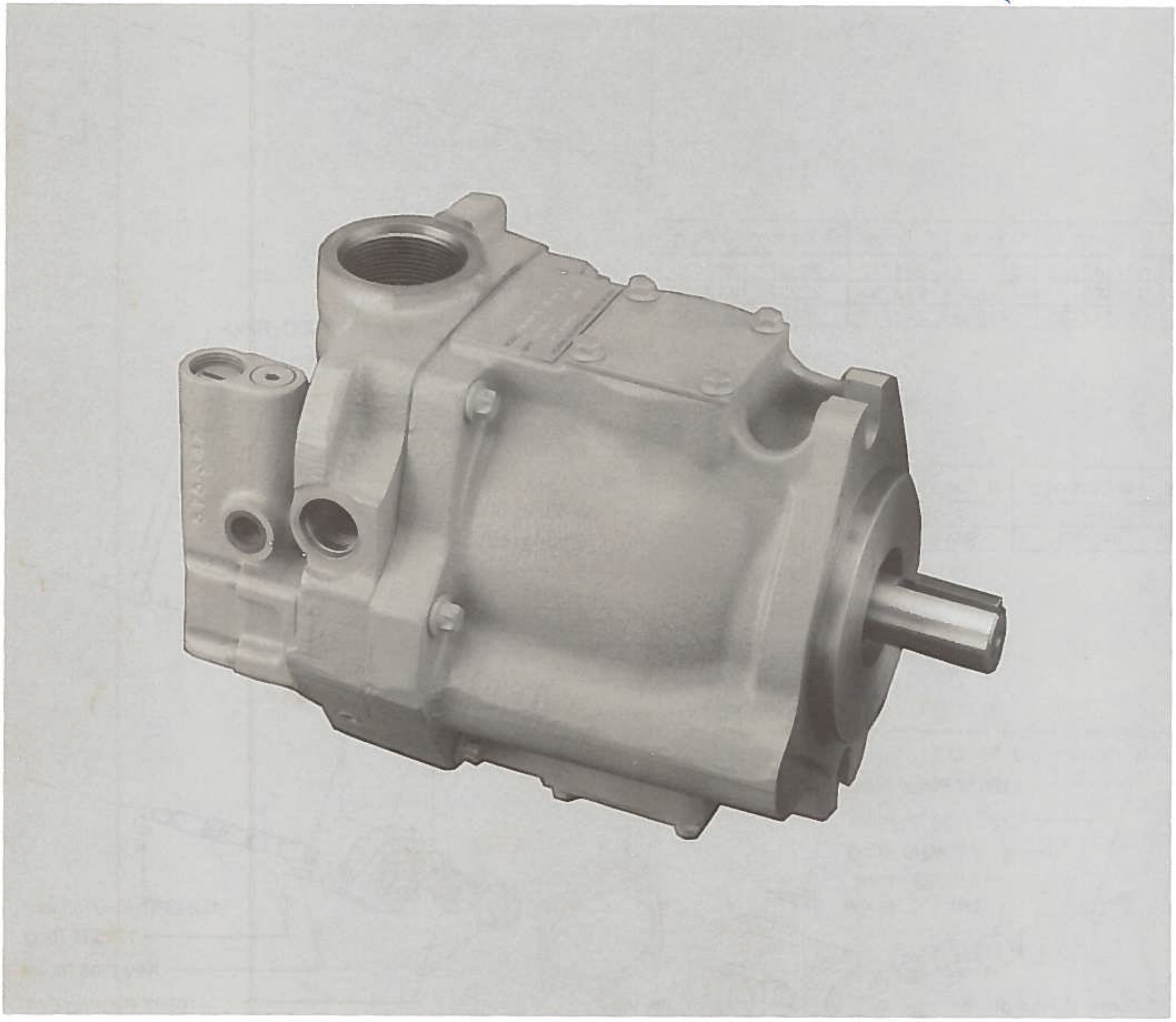
Service Data

VICKERS

Low Noise Industrial Piston Pump

PVQ 40–B2/M2 * * – ** * * – 10 C** *** *** * – 10/11/12/20**
PVQ 45–B2/M2 * * – ** * * – 10 C** *** *** * – 10/11/12/20**



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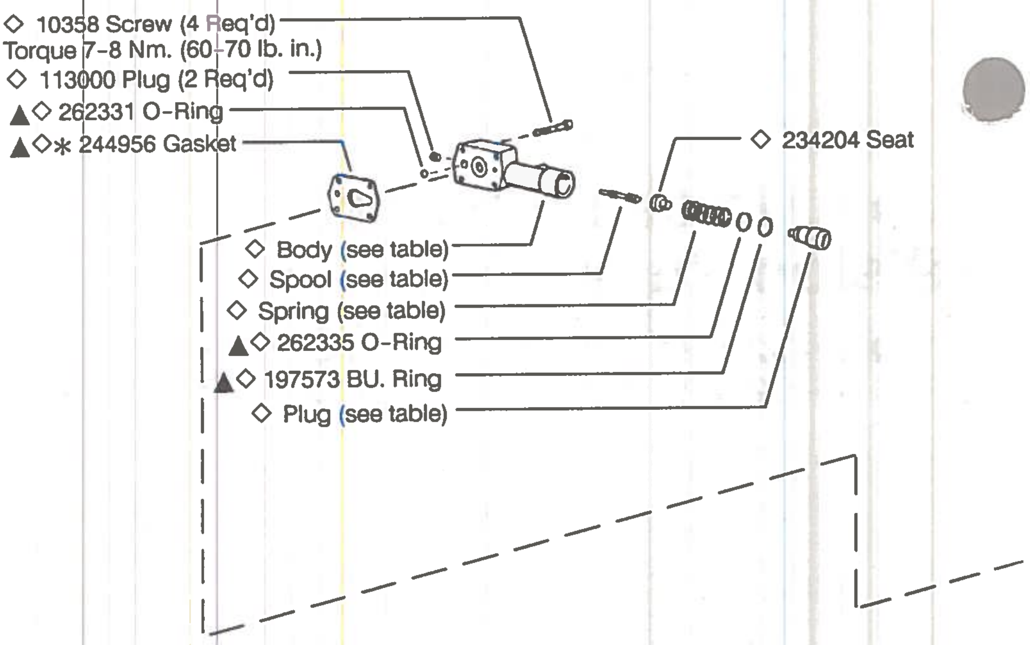
C, CM Compensator shown for R. H. rotation. Rotate 180° for L. H. shaft rotation.

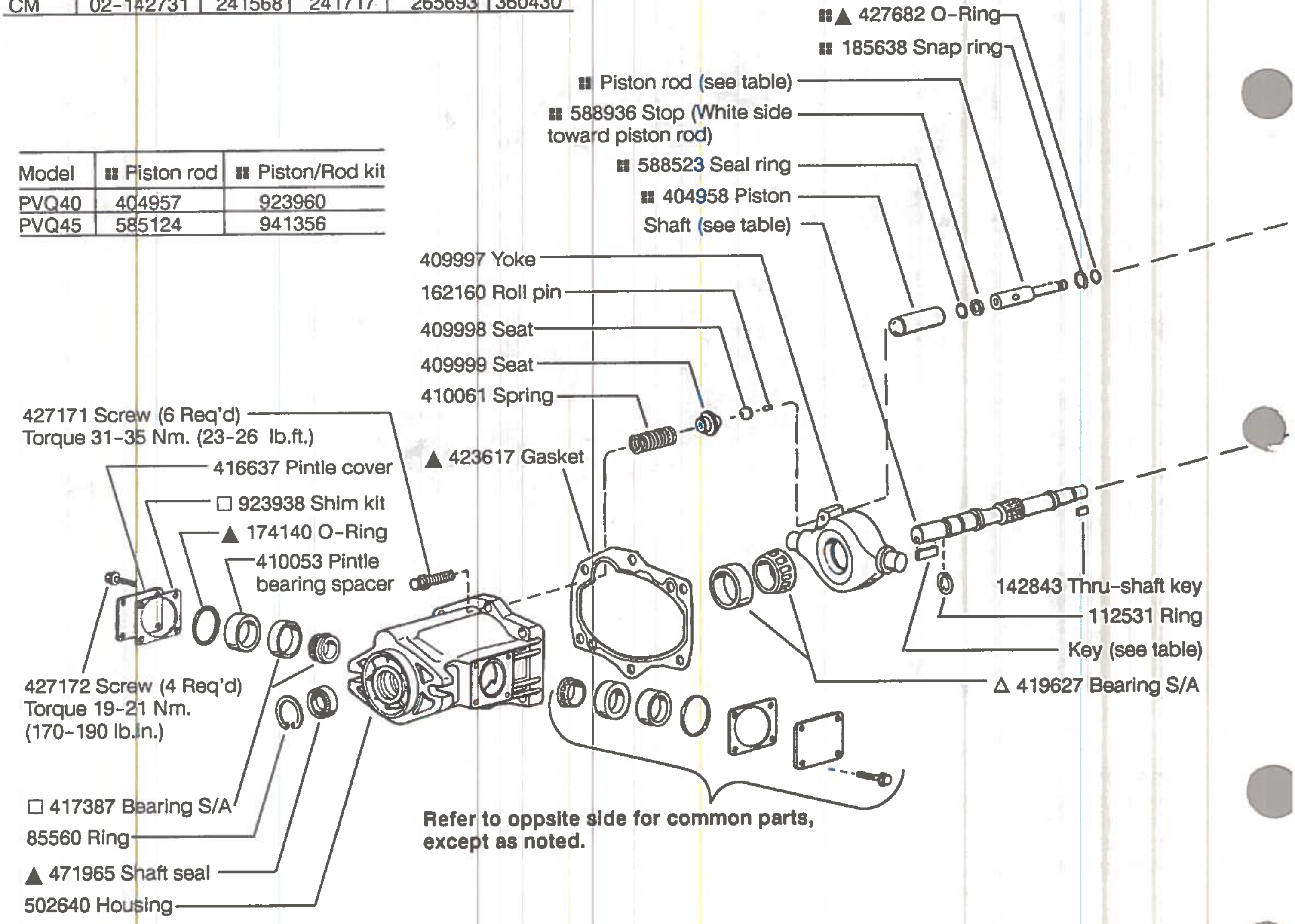


✱ **CAUTION**

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

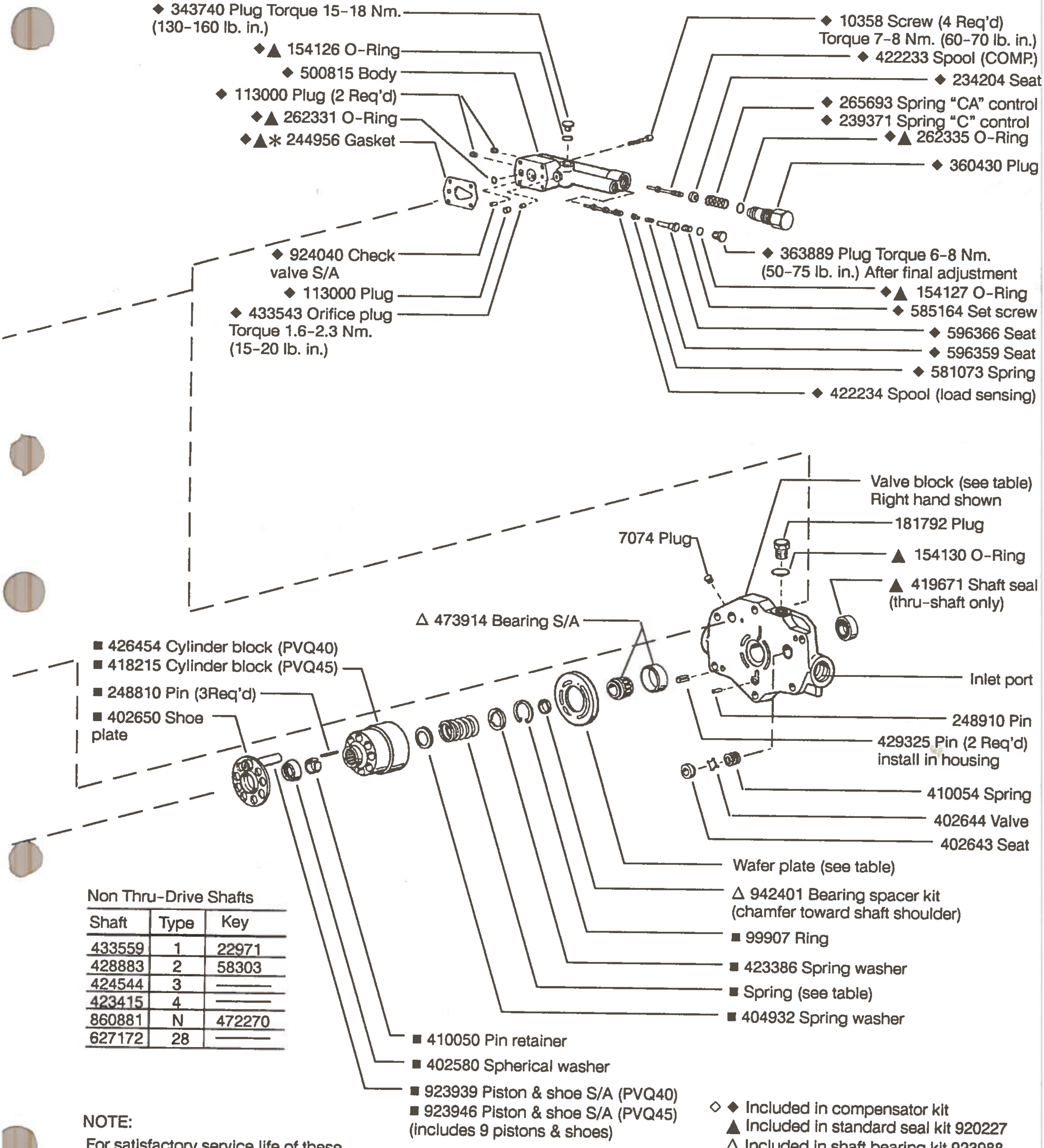
◇ Type	◇ Comp. kit	◇ Body	◇ Spool	◇ Spring	◇ Plug
C	02-142732	241568	241717	239371	360430
CG	942480	412890	296234	239371	412940
CM	02-142731	241568	241717	265693	360430

Model	▦ Piston rod	▦ Piston/Rod kit
PVQ40	404957	923960
PVQ45	585124	941356



Refer to oppsite side for common parts, except as noted.

CVP Compensator shown for R. H. rotation. Rotate 180° for L. H. shaft rotation. See table for compensator kit part number.


◆ 343740 Plug Torque 15-18 Nm. (130-160 lb. in.)
◆▲ 154126 O-Ring
◆ 500815 Body
◆ 113000 Plug (2 Req'd)
◆▲ 262331 O-Ring
◆▲✻ 244956 Gasket
◆ 10358 Screw (4 Req'd) Torque 7-8 Nm. (60-70 lb. in.)
◆ 422233 Spool (COMP.)
◆ 234204 Seat
◆ 265693 Spring "CA" control
◆ 239371 Spring "C" control
◆▲ 262335 O-Ring
◆ 360430 Plug
◆ 924040 Check valve S/A
◆ 113000 Plug
◆ 433543 Orifice plug Torque 1.6-2.3 Nm. (15-20 lb. in.)
◆ 363889 Plug Torque 6-8 Nm. (50-75 lb. in.) After final adjustment
◆▲ 154127 O-Ring
◆ 585164 Set screw
◆ 596366 Seat
◆ 596359 Seat
◆ 581073 Spring
◆ 422234 Spool (load sensing)
Valve block (see table) Right hand shown
181792 Plug
7074 Plug
▲ 154130 O-Ring
▲ 419671 Shaft seal (thru-shaft only)
△ 473914 Bearing S/A
■ 426454 Cylinder block (PVQ40)
■ 418215 Cylinder block (PVQ45)
■ 248810 Pin (3Req'd)
■ 402650 Shoe plate
Inlet port
248910 Pin
429325 Pin (2 Req'd) install in housing
410054 Spring
402644 Valve
402643 Seat
Wafer plate (see table)
△ 942401 Bearing spacer kit (chamfer toward shaft shoulder)
■ 99907 Ring
■ 423386 Spring washer
■ Spring (see table)
■ 404932 Spring washer
■ 410050 Pin retainer
■ 402580 Spherical washer
■ 923939 Piston & shoe S/A (PVQ40)
■ 923946 Piston & shoe S/A (PVQ45) (includes 9 pistons & shoes)

Non Thru-Drive Shafts

Shaft	Type	Key
433559	1	22971
428883	2	58303
424544	3	———
423415	4	———
860881	N	472270
627172	28	———

◇◆ Included in compensator kit
▲ Included in standard seal kit 920227
△ Included in shaft bearing kit 923988
☐ Included in yoke bearing kit 923987
■ Rotating group kit 923948 (PVQ40)
■ Rotating group kit 923947 (PVQ45)

NOTE:

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

Model	■ Spring	Color
PVQ40	632570	Yellow
PVQ45	402579	Red

CAUTION
Model PVQ45C compensator pressure adjustment shall not exceed 2000 psi

10 NOTE: See model code for pressure range settings of individual compensator kits.

Model	◆ Comp. kit	◆ Comp. Spring	◆ Load Sense Spring
PVQ**C	02-142732	239371	——
PVQ**CM	02-142731	265693	——
PVQ**CG	942480	239371	——
PVQ**F/WCG	941353	265693	——
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

Model	Shaft end rotation	Wafer plate	Valve block	Thru-Drive valve block	O-Ring
PVQ45*R*SS	Right hand (CW)	629539	429729	——	——
PVQ40*R*SS					
PVQ45*R*SE			585127	——	
PVQ40*R*SE					
PVQ45*L*SS	Left hand (CCW)	631476	586133	——	
PVQ40*L*SS					
PVQ45*L*SE			585129	——	
PVQ40*L*SE					
PVQ4**RAFS	Right hand (CW)	629539	——	857668	351776
PVQ4**RBSS			——	627149	375422
PVQ4**LAFS	Left hand (CCW)	631476	——	568082	351776
PVQ4**LBSS			——	627541	375422

Thru-Drive Shafts

5 Model	Shaft	7 Input Type
PVQ**A9	883098	2 Str. Keyed SAE B-B
	586131	4 Splined SAE B-B
PVQ**B26	677131	2 Str. Keyed SAE B-B
	423416	4 Splined SAE B-B

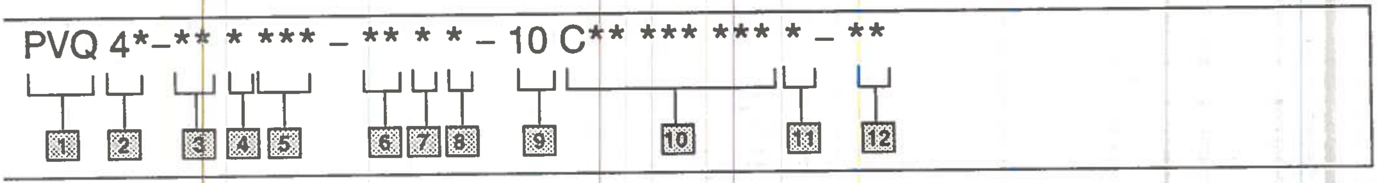
Thru-Drive Couplings

Thru-Drive Model Code	Coupling	O-Ring	Model Code Rear Pump	Rear Pump Shaft Type
PVQ**A9	864224	351776	PVQ10	3
			V10	11
			V20	62
PVQ**B26	627168	375422	PVE12	28
			PVQ40/45	28
			PVQ20/32	28
	475134		2520V	166

Rear pump, couplings, O-rings, capscrews and washers must be ordered separately to mount rear pump.

Thru-Drive Couplings	Type	Discription
864224	A	“A” 9 tooth spline
627168	B	26 tooth
475134	B	Step coupling 26 to tooth “B-B” spline

Model Code



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement
(CC/Rev & Pressure ratings)

40 – 40 CC/Rev (2.50 CIR)
210 bar (3000 psi)
45 – 45 CC/Rev (2.75 CIR)
190 bar (2700 psi)

3 Mounting flange

B2 – SAE "B" 2-bolt
MB – ISO 3019/2 "B" 2-bolt (available with "N" drive shaft only)

4 Rotation
(viewed from shaft end)

R – Right hand (CW) (standard)
L – Left hand (CCW) (optional)

5 Thru drive
(without coupling) Available with side ports only.

Blank – No thru drive
A9 – SAE "A" 2-bolt with 9T shaft
A11 – SAE "A" 2-bolt with 11T shaft
B13 – SAE "B" 2-bolt with 13T shaft
B26 – SAE "B" 2-bolt with 26T shaft
(Available only with #4 main input shaft)

6 Ports
(type and location)

SE – Inch O-Ring boss rear port (standard)
SS – Inch O-Ring boss side port (optional)
FS – Flange side port (SAE "A" thru-drive only)

7 Shafts
(input)

1 – Straight keyed SAE "B"(not on thru drives)
2 – Straight keyed SAE "B-B"
3 – Splined SAE "B" modified 13T, 16/32 DP flat root side fit (not on thru drives)
4 – Splined SAE "B-B" modified 15T, 16/32 DP flat root side fit
N – ISO 3019/2 short straight keyed (available with "MB" mounting only) Not available on thru-drives.
28 – 26 tooth splined shaft (Vickers) Used to mount PVQ40/45 on PVQ40/45 thru-drive pump

8 Seals

S – Buna N (standard)
F – Fluorocarbon (optional)

9 Pump design number

10 – First design

10 Control type

C** – Pressure compensator, PVQ40: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ45: Std. model is C19, indicating factory setting of 190 bar (2750 psi). Range is 02-19 in tens of bar (350-2750 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
CV**B** – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice.
Example: C21V11B indicates PVQ40 compensator with 210 bar pressure setting and 11 bar load sense differential.
CV**P** – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
CVC**B** – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
CVC**P** – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD**** – Electric dual range compensator. PVQ40: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ45: Std. model is CD1910, indicating settings of 190 and 100 bar, adjustment ranges are 20-190 bar (high) and 20-100 bar (low).

11 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

12 Control design

10 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

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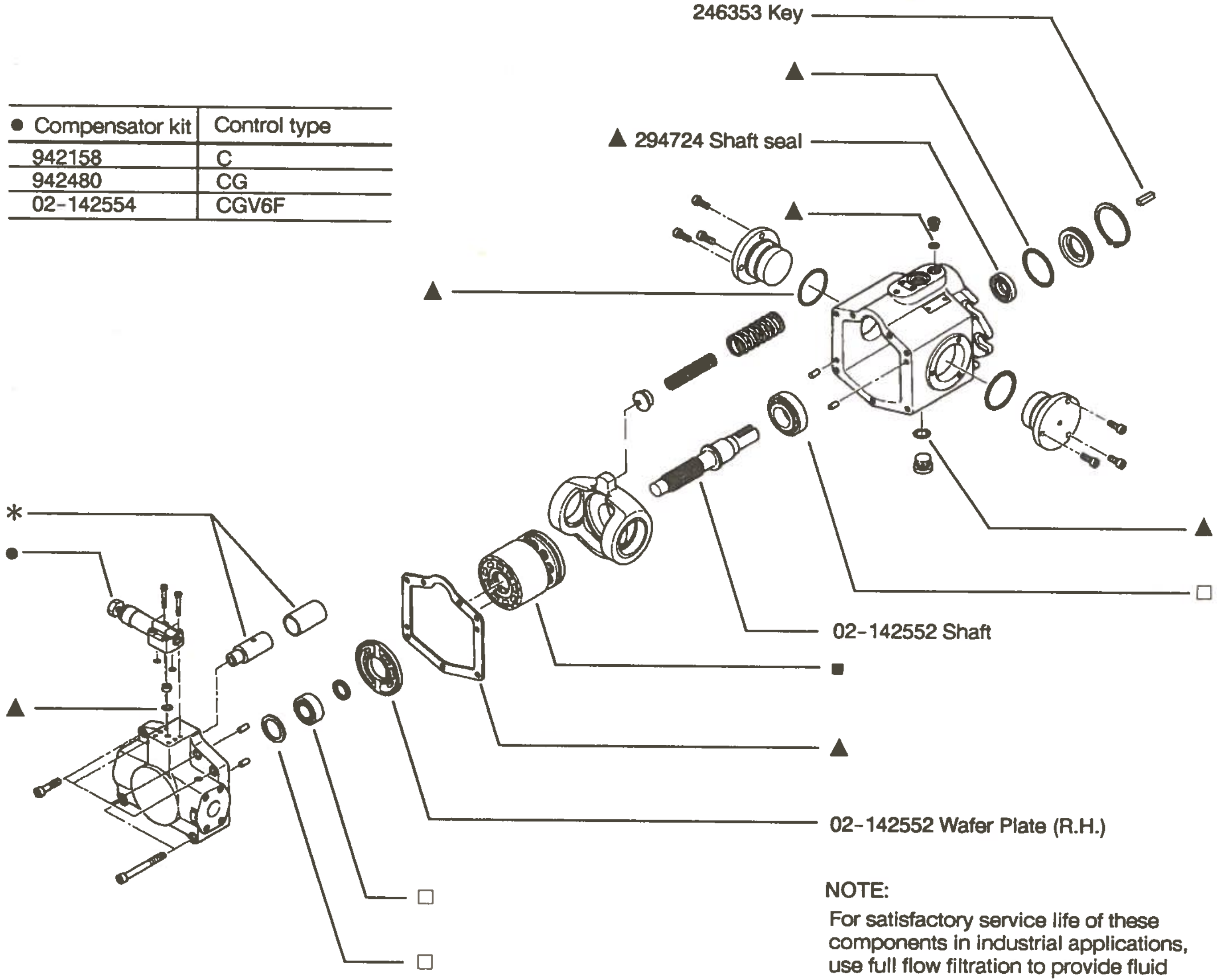
VICKERS

Service Parts Information

Model : PVQ 63-C2 * *** - ** * * - 10/20 C** *** *** * - 12
Low Noise Industrial Piston Pump

● Compensator kit	Control type
942158	C
942480	CG
02-142554	CGV6F



NOTE:
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

EDG control	Control type
942158	Control valve
942480	LVDT S/A
02-142554	Sequence valve

■ Rotating Group kit	02-142577
□ Bearing Kit	02-142550
● Compensator kit	(see table)
▲ Seal Kit	02-142593
* Stroking Piston	02-142553

Model Code

PVQ 63–C2 * – ** * * – ** *** *** *** * – 1*

1 2 3 4 5 6 7 8 9 10 11

1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement

(CC/Rev & Pressure ratings)

63 – 63.0 CC/Rev (3.84 CIR)
207 bar (3000 psi)

3 Mounting flange

C2 – SAE "C" 2-bolt

4 Rotation

(viewed from shaft end)

R – Right hand (CW)
L – Left hand (CCW)

5 Ports

(type and location)

FS – Flange SAE side port

6 Shafts

(input)

1 – Straight keyed SAE "C", long

7 Seals

(input shaft all types)

S – Buna N (standard)

8 Pump design number

10 – Design (EDG control)
20 – Design (C** control)

9 Control type

C** – Pressure compensator, Std. setting 21 in tens of bar (max. setting 210 bar) 3000 psi
Range 02-21 in tens of bar
CG – Compensator for hydraulic remote control
CGV6F – Remote pressure compensator with high response load sensing control. Load sensing setting is 6 bar (87 psi) Delta P without bleed down orifice.
EDG – Direct electric displacement control with remote pressure compensator

10 Control option

Does not apply

11 Control design

1* – Current design number

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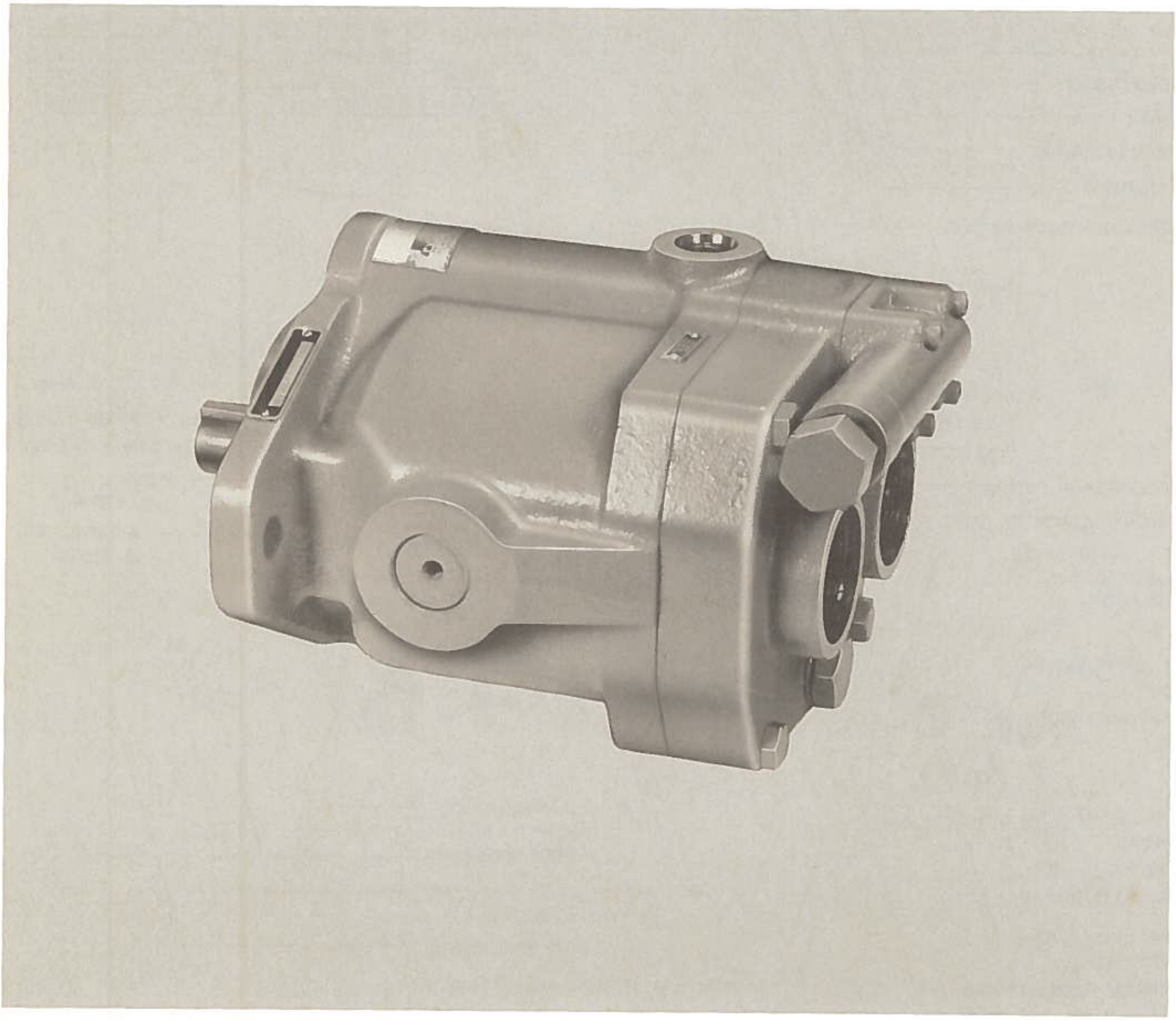
Service Data

VICKERS

Low Noise Industrial Piston Pump

PVQ 20-B2/MB * *** - ** * * - 10 C** *** *** * - 11/12/20
PVQ 32-B2/MB * *** - ** * * - 10 C** *** *** * - 11/12/20



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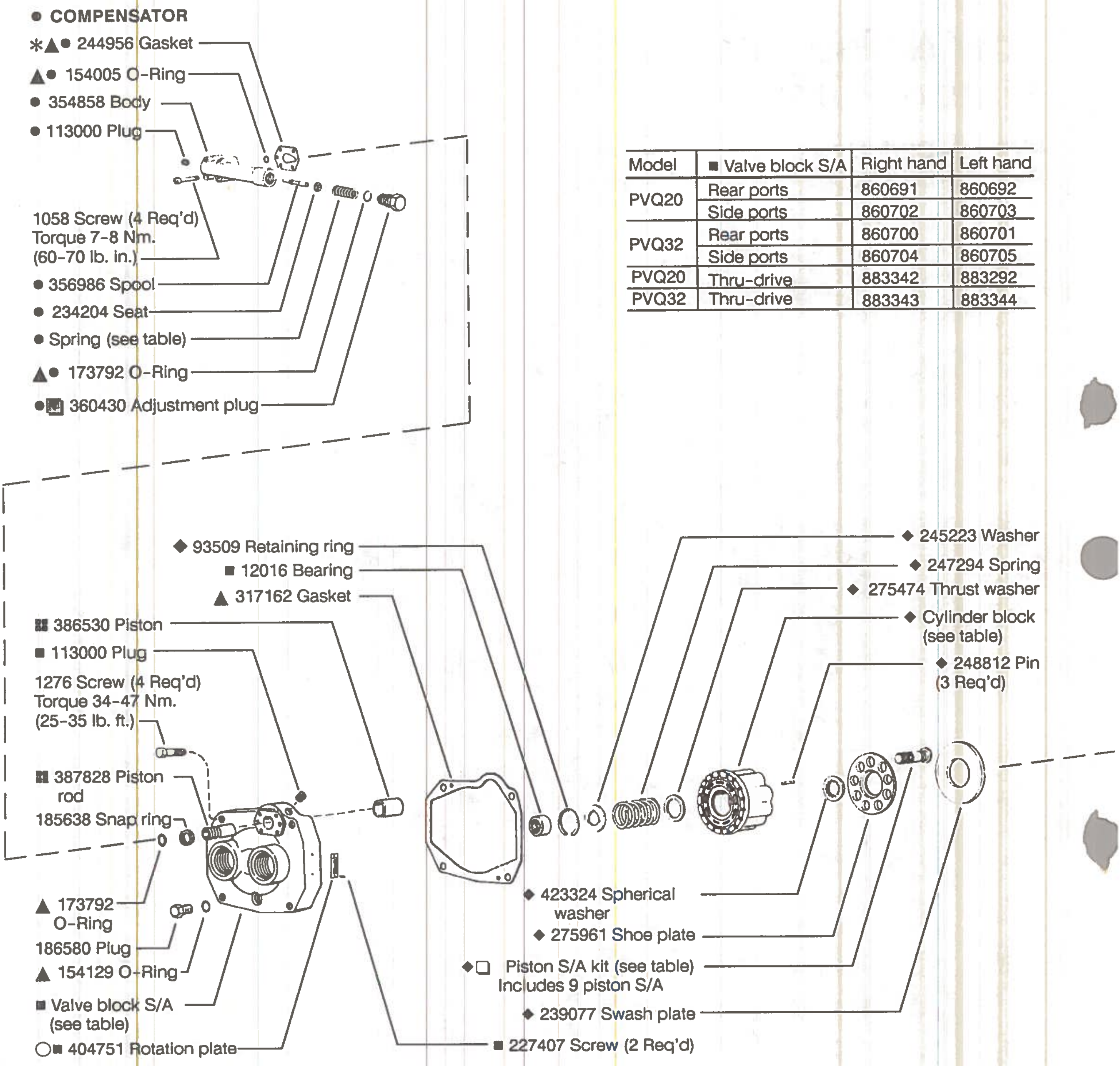
Released 11-01-91

⁎ CAUTION

Position gasket with small end of teardrop hole pointing in direction of compensator adjusting plug

● NOTE:

Compensator shown for left hand shaft rotation. Rotate 180° for right hand shaft rotation.



Model	■ Valve block S/A	Right hand	Left hand
PVQ20	Rear ports	860691	860692
	Side ports	860702	860703
PVQ32	Rear ports	860700	860701
	Side ports	860704	860705
PVQ20	Thru-drive	883342	883292
PVQ32	Thru-drive	883343	883344

Model	◆ Cylinder block	☐◆ Piston S/A kit	◆ Rotating group kit
PVQ20	321703	942047	938276
PVQ32	260860	941887	938273

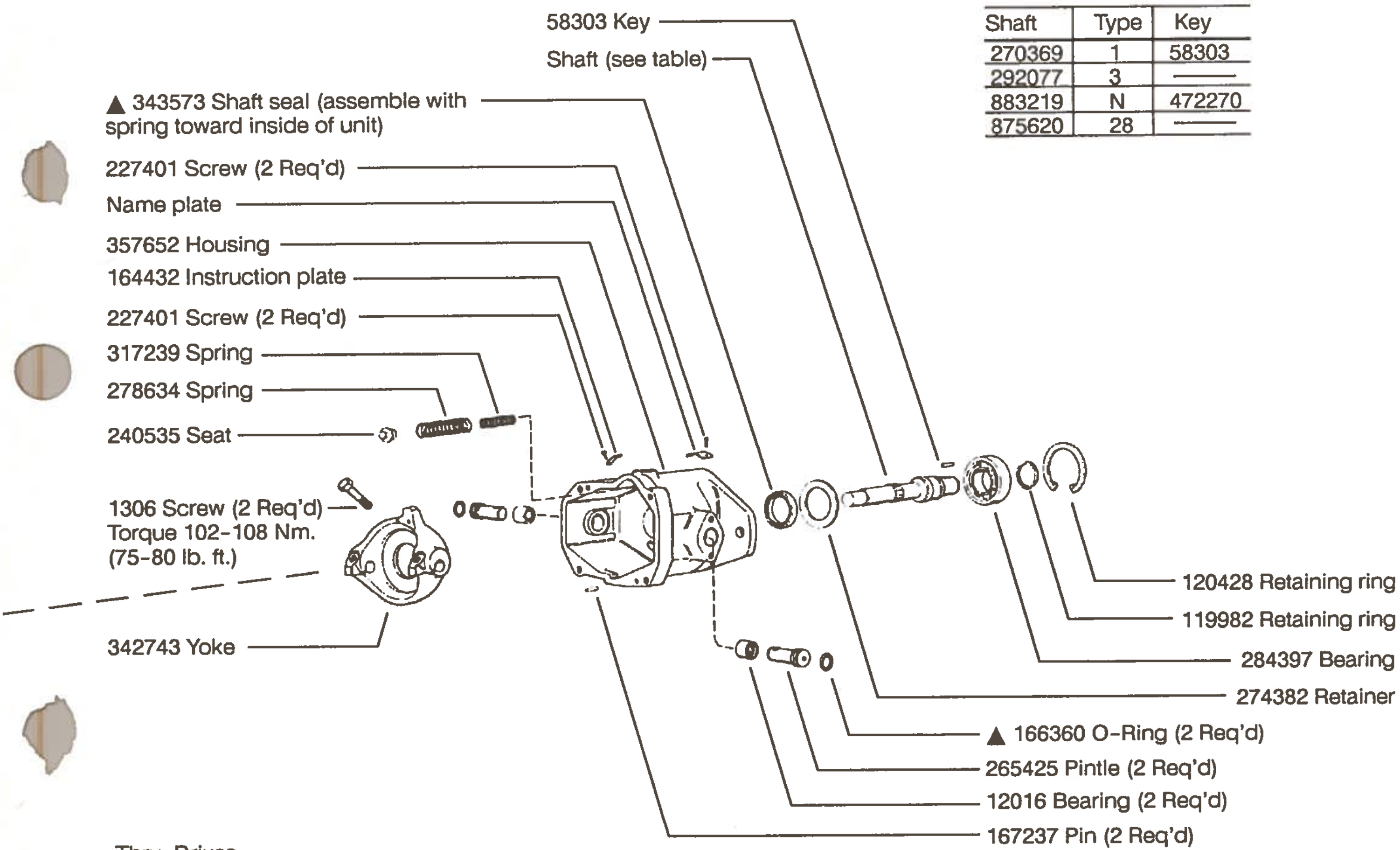
CAUTION
Model PVQ32C compensator pressure adjustment shall not exceed 2000 psi

10 NOTE: See model code for pressure range settings of individual compensator kits.

Model	● Comp. kit	● Comp. Spring	● Load Sense Spring
PVQ**C	942158	239371	———
PVQ**CM	942159	265693	———
PVQ**CG	942480	239371	———
PVQ**FCG	941353	265693	———
PVQ**C**V(C)11B	02-142729	239371	581073
PVQ**C**V(C)11P	02-142728	239371	581073
PVQ**C**V(C)24B	02-142730	239371	581072
PVQ**C**V(C)24P	02-142727	239371	581072
PVQ**CD****	(Refer to service parts information I-3255-S)		

Non Thru-Drive Shaft

Shaft	Type	Key
270369	1	58303
292077	3	———
883219	N	472270
875620	28	———



Thru-Drives

5 Model	Shaft	Coupling	Snap Ring	O-Ring	7 Input Type
PVQ**A9	883302	426770	223172	351776	1 Str. Keyed SAE B
PVQ**A11	860501	577937	92757		
Couplings, coupling retaining rings, O-rings, capscrews and washers must be ordered separately to mount rear pump.					

NOTE:

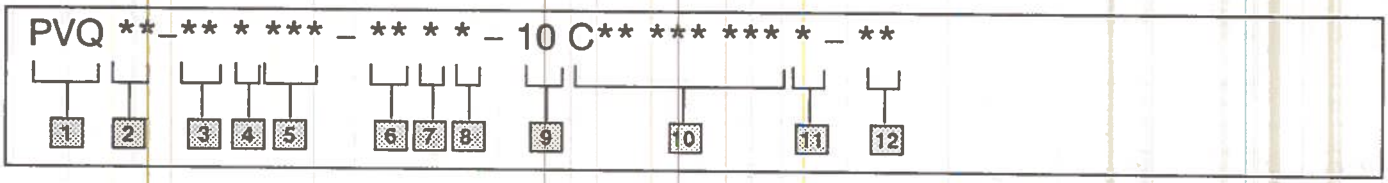
For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. OFP, OFR, and OFRS series filters are recommended.

○ NOTE:

Rotation plate shown for right hand shaft rotation. Assemble on opposite side of valve plate for left hand rotation.

▲ Standard seal kit 919682
F3 equivalent seal kit 919686
● Compensator kit (see table)
■ Valve block S/A (see table)
◆ Rotating group kit (see table)
☐ Piston S/A kit (see table)
▪ Piston/Rod S/A kit 942327

Model Code



1 PVQ Series

P – Inline piston pump
V – Variable volume
Q – Quiet series

2 Displacement

(CC/Rev & Pressure ratings)

20 – 20 CC/Rev (1.28 CIR)
210 bar (3000 psi)
32 – 32 CC/Rev (2.01 CIR)
140 bar (2000 psi)

3 Mounting flange

B2 – SAE "B" 2-bolt
MB – ISO 3019/2 "B" 2-bolt (available with "N" drive shaft only)

4 Rotation

(viewed from shaft end)

R – Right hand (CW) (standard)
L – Left hand (CCW) (optional)

5 Thru drive

(without coupling) Available with side ports only.

Blank – No thru drive
A9 – SAE "A" 2-bolt with 9T shaft
A11 – SAE "A" 2-bolt with 11T shaft

6 Ports

(type and location)

SE – SAE O-Ring rear port, 1.625 inch (Inlet & Outlet) (standard)
SS – SAE O-Ring side port, 1.625 inch (Inlet & Outlet) (optional)

7 Shafts

(input)

1 – Straight keyed SAE "B" modified 2.31 inch long
3 – Splined SAE "B" modified 13T, 16/32 DP major dia. fit
N – ISO 3019/2 short straight keyed (available with "MB" mounting only) Not available on thru-drives
28 – 26 Tooth splined shaft (Vickers) Used to mount PVQ20/32 on PVQ40/45 "B26" thru drive

8 Seals

S – Buna N (standard)
F – Fluorocarbon (optional)

9 Pump design number

10 – First design

10 Control type

C** – Pressure compensator, PVQ20: Std. model is C21, indicating factory setting of 210 bar (3000 psi). Range is 02-21 in tens of bar (350-3000 psi)
PVQ32: Std. model is C14, indicating factory setting of 140 bar (2000 psi). Range is 02-14 in tens of bar (350-2000 psi)
CM** – Low pressure compensator, Std. model is CM7, indicating factory setting of 70 bar(1000 psi). Range is 02-10 in tens of bar (350-1500 psi)
CV**B** – Pressure compensator C**, as above, with load sensing. Std. load sensing setting is 11 bar (160 psi). Range 10-17 bar (150-250 psi), with bleed down orifice. Example: C21V11B indicates compensator with 210 bar pressure setting and 11 bar load sense differential.
CV**P** – Pressure compensator with load sensing as C**V**B above, but with bleed down orifice plugged.
CVC**B** – Pressure compensator with load sensing. Compensator same as C** above. Std. load sensing setting is 24 bar (350 psi). Range 17-31 bar (250-450 psi), with bleed down orifice
CVC**P** – Pressure compensator with load sensing.Same as C**VC**B above, but with bleed down orifice plugged.
CG – Pressure compensator modified for hydraulic remote control.
CD** – Electric dual range compensator. PVQ20: Std. model is CD2110, indicating dual pressure settings of 210 and 100 bar, adjustment ranges are 20-210 bar (high) and 20-100 bar (low). PVQ32: Std. model is CD1407, indicating settings of 140 and 70 bar, adjustment ranges are 20-140 bar (high) and 20-100 bar (low).

11 Control option

Blank – Without adjustable Max. displacement stop (standard)
D – Max. adjustable displacement stop (optional)

12 Control design

11 – For C** & CM**
11 – For C**D & CM**D
12 – For C**V(C)**B & C**V(C)**P
20 – CD**** & CG

The right to modifications for technical improvements is reserved.

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Service Parts Information

19 & 21 GPM
Variable
Inline
Piston
Units

PVE19/21G5-6R-2-30-C***-1*

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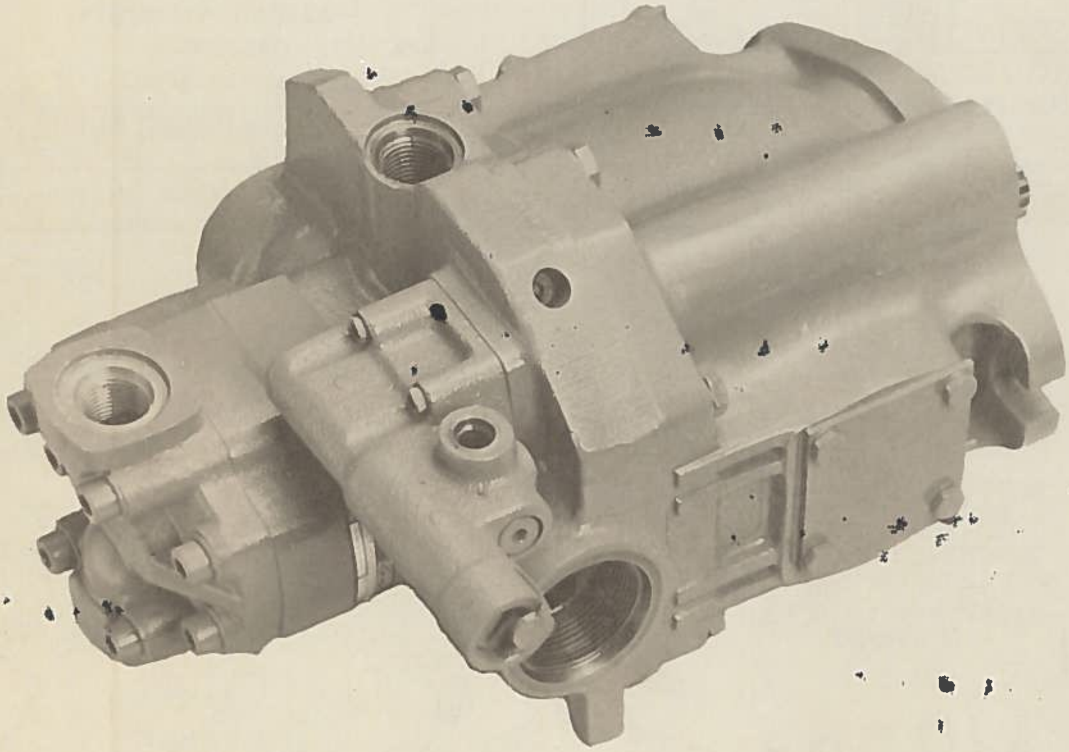

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M-2823-S

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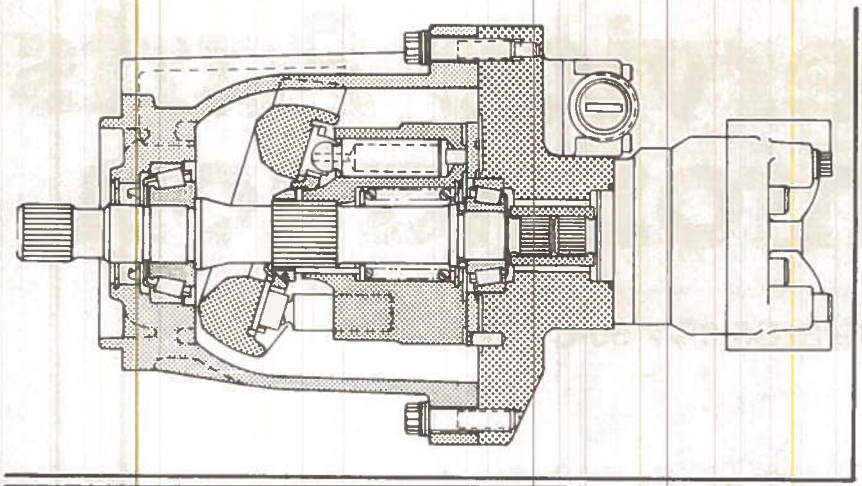


◆ASSEMBLY NOTE
ADJUST COMPENSATOR THEN DRILL THRU WITH A 0.089 DRILL. INSERT LOCKWIRE THRU SEAL, THEN COMPRESS SEAL WITH A SUITABLE TOOL.

NOTE
THE COMPENSATORS MAY BE OBTAINED AS COMPLETE FACTORY TESTED UNITS BY ORDERING KIT SHOWN IN TABLE.

C,CG, & CV COMPENSATOR

(SHOWN FOR RIGHT HAND SHAFT ROTATIO
ROTATE 180° FOR LEFT HAND SHAFT ROTAT

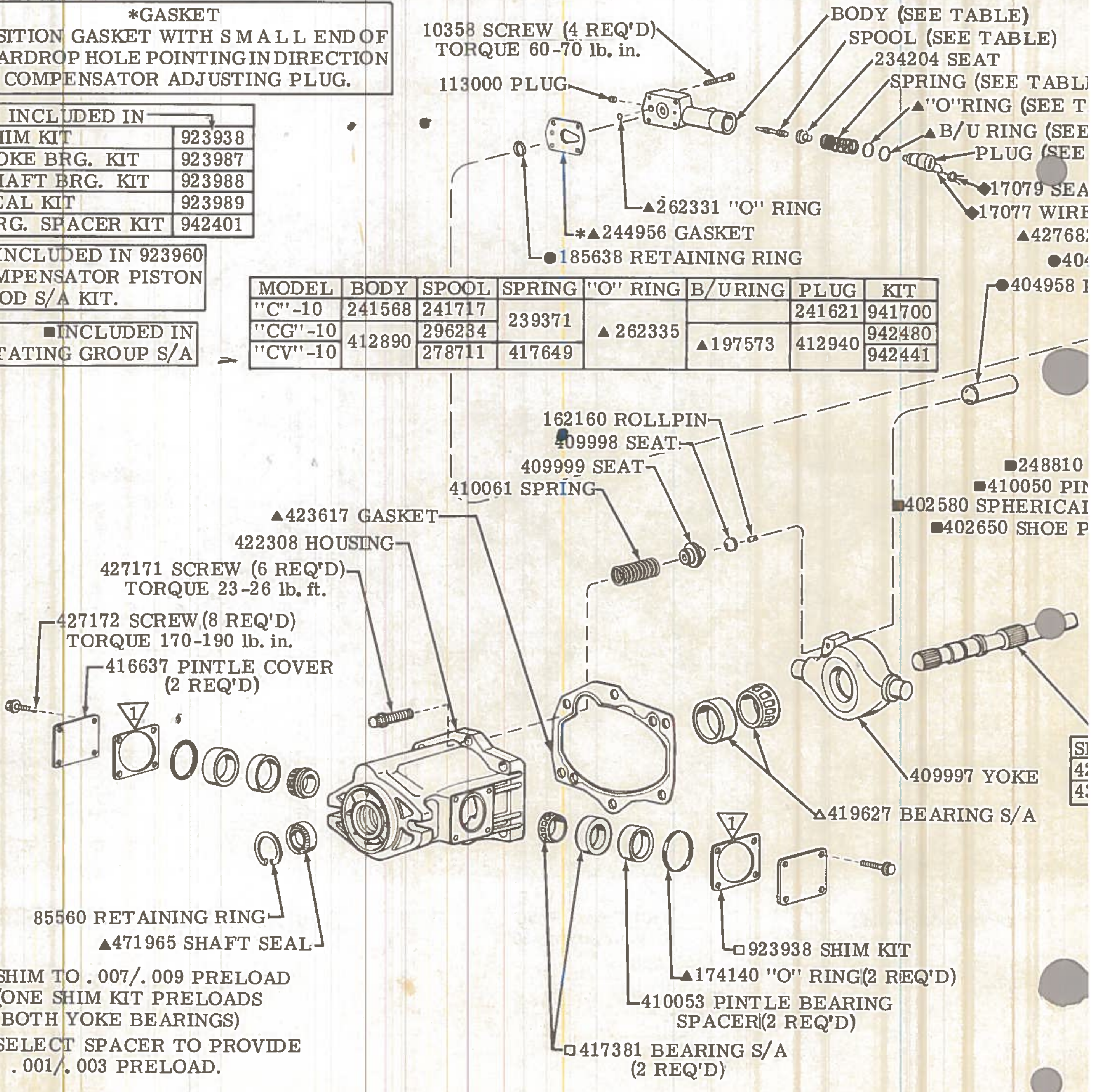
*GASKET
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJUSTING PLUG.

	INCLUDED IN
SHIM KIT	923938
□ YOKE BRG. KIT	923987
△ SHAFT BRG. KIT	923988
▲ SEAL KIT	923989
BRG. SPACER KIT	942401

●INCLUDED IN 923960 COMPENSATOR PISTON & ROD S/A KIT.

■INCLUDED IN ROTATING GROUP S/A

MODEL	BODY	SPOOL	SPRING	"O" RING	B/U RING	PLUG	KIT
"C"-10	241568	241717	239371	▲262335		241621	941700
"CG"-10	412890	296234			▲197573	412940	942480
"CV"-10		278711	417649				942441

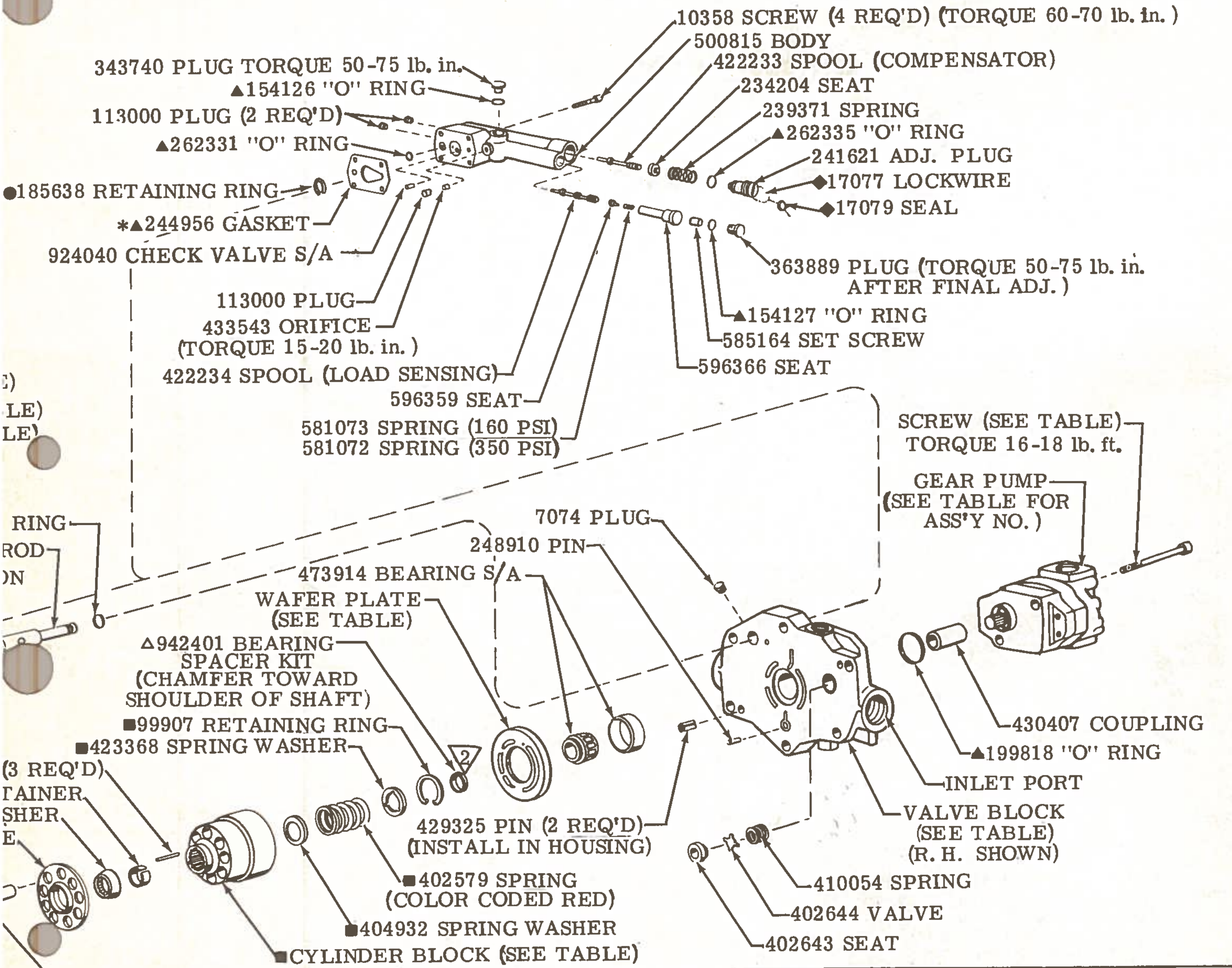


1 SHIM TO .007/.009 PRELOAD (ONE SHIM KIT PRELOADS BOTH YOKE BEARINGS)

2 SELECT SPACER TO PROVIDE .001/.003 PRELOAD.

CVP(C) COMPENSATOR

SHOWN FOR RIGHT HAND SHAFT ROTATION. ROTATE 180° FOR LEFT HAND SHAFT ROTATION. SEE TABLE FOR CVP S/A PART NUMBERS.



T	TYPE	MODEL
5	SPLINE	PVE19/21G5-2
7		PVE19/21G5-9

ASS'Y NO	MODEL	ROTATION (VIEWED FROM SHAFT END)	SCREW (2 REQ'D)	FLOW 1800 RPM
926401	G5-12-J5R2-21L	C'CLOCKWISE	426381	6 GPM
924073	G5-12-J5S2-21	CLOCKWISE		
924072	G5-12-J5S2-21L	C'CLOCKWISE		
924071	G5-20-J5R2-21	CLOCKWISE	435711	9 GPM
926500	G5-20-J5R2-21L	C'CLOCKWISE		
926402	G5-20-J5R4-21	CLOCKWISE		

NOTE: GEAR PUMP MODEL IS STAMPED INTO SHAFT END COVER OF PUMP. IF PUMP IS DEFECTIVE, ORDER BY ASSEMBLY NUMBER.

MODEL	VALVE BLOCK	WAFER PLATE	■INCLD IN ROT GRP KIT			LOAD SENSING DIFF.	
			CYL. BLOCK	PISTON KIT	ROT. GROUP	CVP KIT △160 PSI	CVPC KIT △350 PSI
PVE19G5-*L	595464	425415	426454	923939	923948	924061	924062
PVE21G5-*L	595464	425416	418215	923946	923947	924063	924064

MODEL CODE BREAKDOWN

PVE ** G5-6R-2-30-C* -1* -*****

PUMP

VARIABLE DISPLACEMENT

INLINE PISTON UNIT
E - SERIES

FLOW RATING @1800 RPM
19 - 19 GPM
21 - 21 GPM

AUXILIARY GEAR PUMP
5 - SERIES

GEAR PUMP FLOW RATE @1800 RPM
6 - 6 GPM
9 - 9 GPM

SHAFT ROTATION (VIEWED FROM SHAFT END)
R - RIGHT HAND CLOCKWISE
L - LEFT HAND COUNTERCLOCKWISE

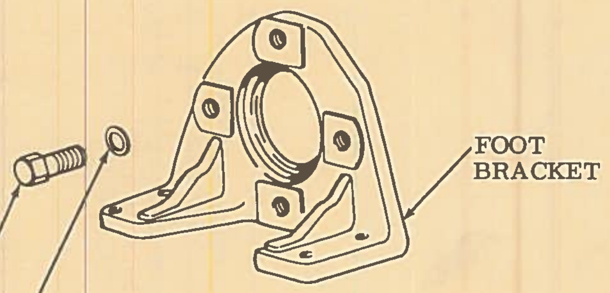
INPUT SHAFT
1 - SAE B - B STR. KEYED
2 - SAE B - B SPLINED

PUMP DESIGN

CONTROL TYPE
C-10 PRESSURE COMPENSATOR 300-3000 PSI (PVE19) 300-2700 PSI (PVE21)
CV-10 LOAD SENSING
CVP-12 LOAD SENSING WITH PRESSURE LIMITER CONTROL DIFFERENTIAL 160 PSI STD
CVPC-12 LOAD SENSING WITH PRESSURE LIMITER CONTROL DIFFERENTIAL 350 PSI STD.
CG-10 REMOTE CONTROL

SPECIAL FEATURE

TO CONVERT FLANGE MODEL TO A FOOT BRACKET MODEL, ORDER FOOT BRACKET KIT FB-B-10 (ASS'Y NO. 422583)



199740 SCREW (2 REQ'D)
TORQUE TO 54-66 lb. ft.

427700 WASHER (2 REQ'D)

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

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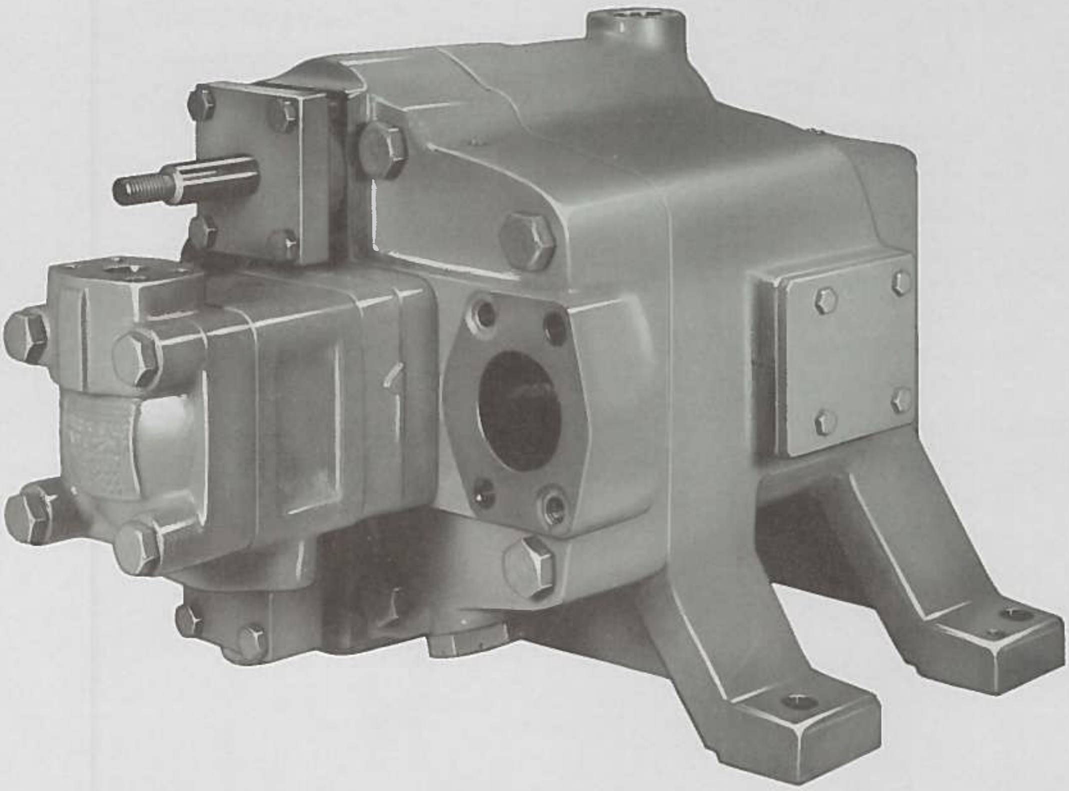
Service Parts Information

Inline Piston Pump With Stem Servo Control

(F3)-PVB45-F*DF-21-DA(A)-31

60



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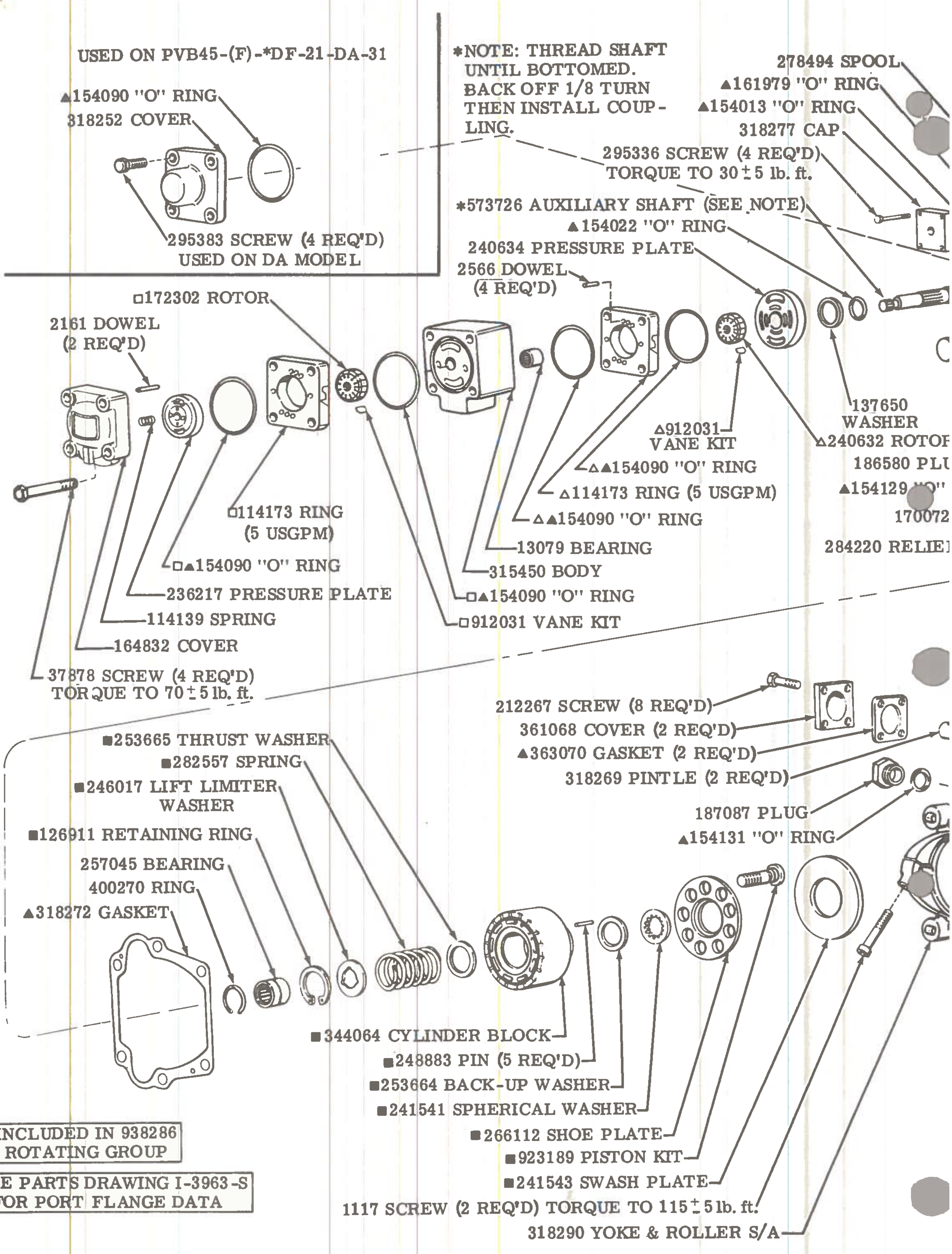
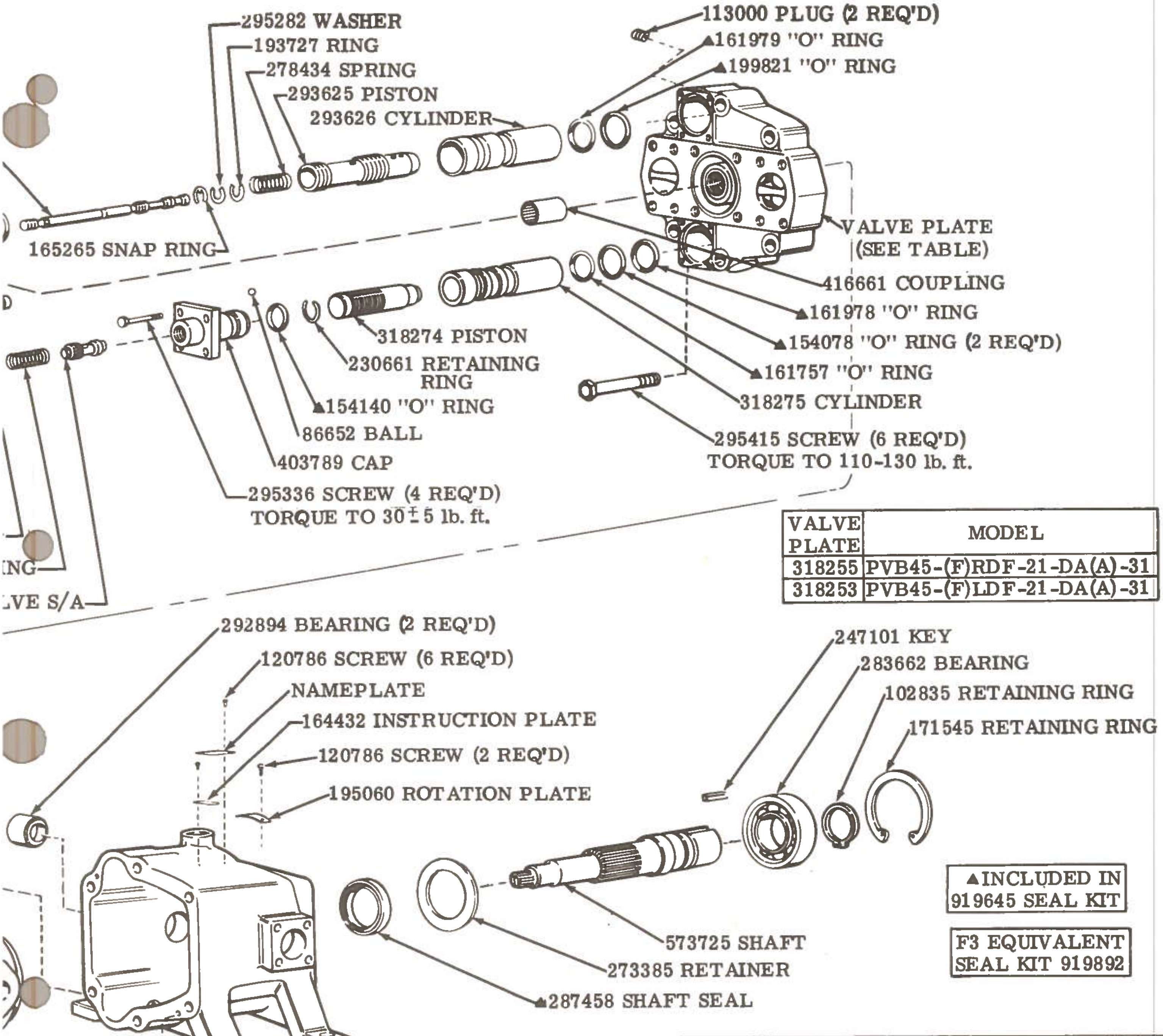
I-3269-S



■ INCLUDED IN 938286
ROTATING GROUP

SEE PARTS DRAWING I-3963-S
FOR PORT FLANGE DATA



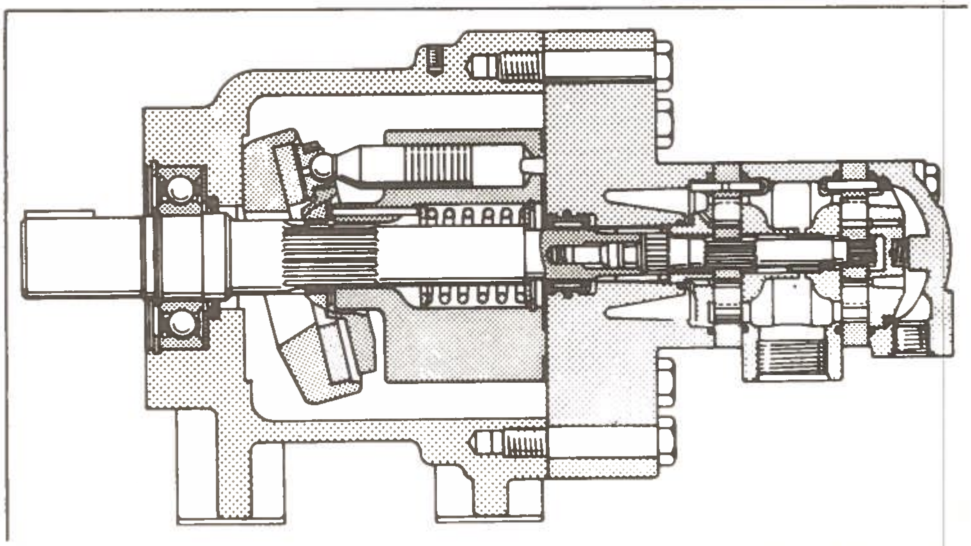
VALVE PLATE	MODEL
318255	PVB45-(F)RDF-21-DA(A)-31
318253	PVB45-(F)LDF-21-DA(A)-31

▲INCLUDED IN 919645 SEAL KIT

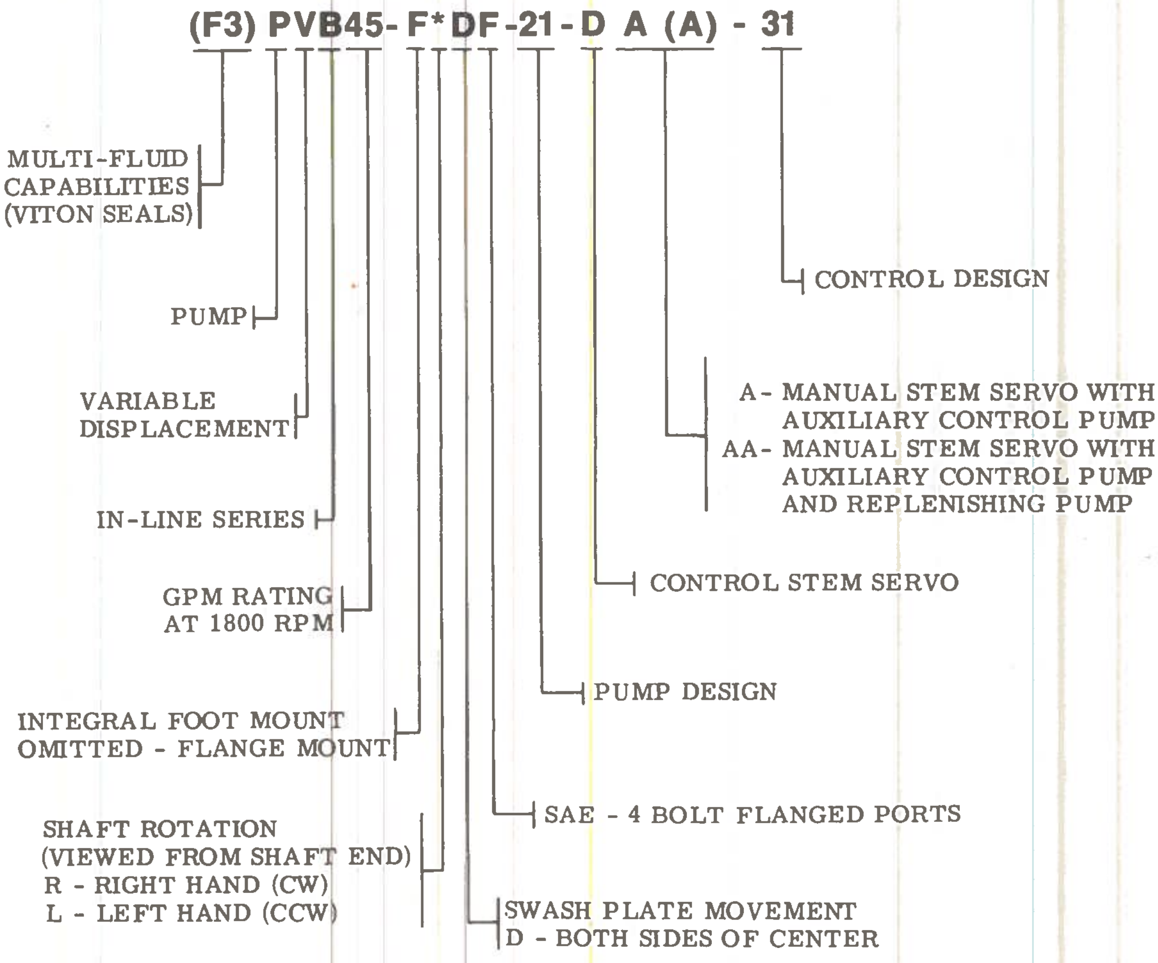
F3 EQUIVALENT SEAL KIT 919892

□INCLUDED IN 912064 CARTRIDGE KIT

△INCLUDED IN 912196 CARTRIDGE KIT



MODEL CODE BREAKDOWN


(F3) PVB45- F* DF -21 - D A (A) - 31
MULTI-FLUID CAPABILITIES (VITON SEALS)
PUMP
VARIABLE DISPLACEMENT
IN-LINE SERIES
GPM RATING AT 1800 RPM
INTEGRAL FOOT MOUNT OMITTED - FLANGE MOUNT
SHAFT ROTATION (VIEWED FROM SHAFT END)
R - RIGHT HAND (CW)
L - LEFT HAND (CCW)
SWASH PLATE MOVEMENT
D - BOTH SIDES OF CENTER
SAE - 4 BOLT FLANGED PORTS
PUMP DESIGN
CONTROL STEM SERVO
A - MANUAL STEM SERVO WITH AUXILIARY CONTROL PUMP
AA - MANUAL STEM SERVO WITH AUXILIARY CONTROL PUMP AND REPLENISHING PUMP
CONTROL DESIGN

For satisfactory service life of these components, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from OFP, OFR and OFRS filter series are recommended.

Litho in U. S. A.

(85)

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Service Parts Information

5 and 6 GPM Variable, Side Ported, Inline Piston Units

PVB5-(F)**WY-20-*(*)(*)-1*
PVB5-(F)**XY-20-*(*)(*)-1*
PVB6-(F)**WY-20-*(*)(*)-1*
PVB6-(F)**XY-20-*(*)(*)-1*

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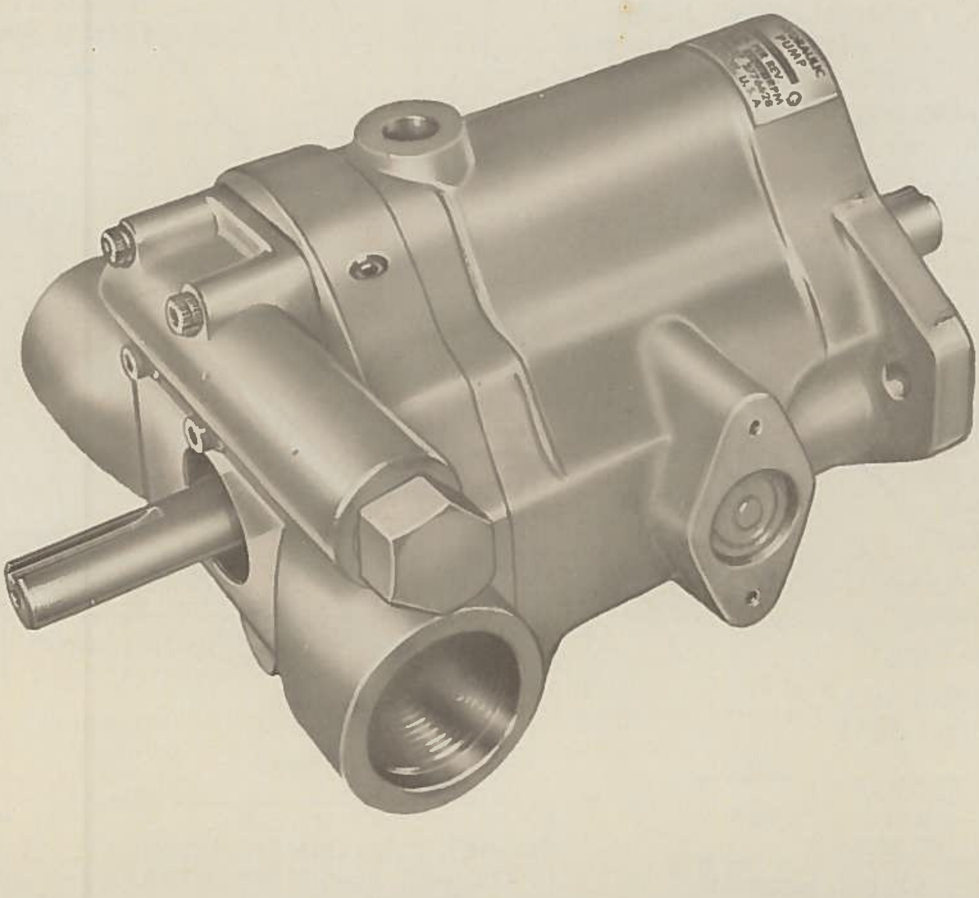

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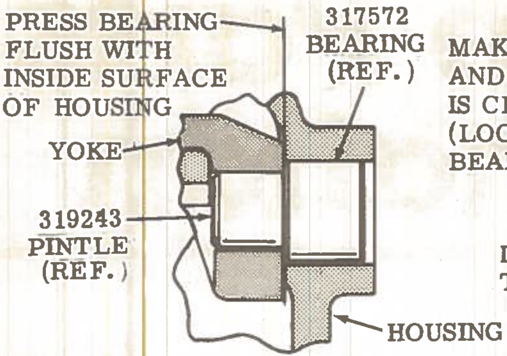
I-3261-S ✓



PINTLE BEARING ASSEMBLY NOTE

MAKE CERTAIN THE BEARING O. D. SURFACE AND THE MATING SURFACE IN THE HOUSING IS CLEAN. APPLY SEALING COMPOUND (LOCTITE A (10-1) OR EQUIVALENT) TO THE BEARING O. D. AND PRESS IN PLACE.

CAUTION

DO NOT ALLOW SEALING COMPOUND TO CONTACT THE BEARING NEEDLES.

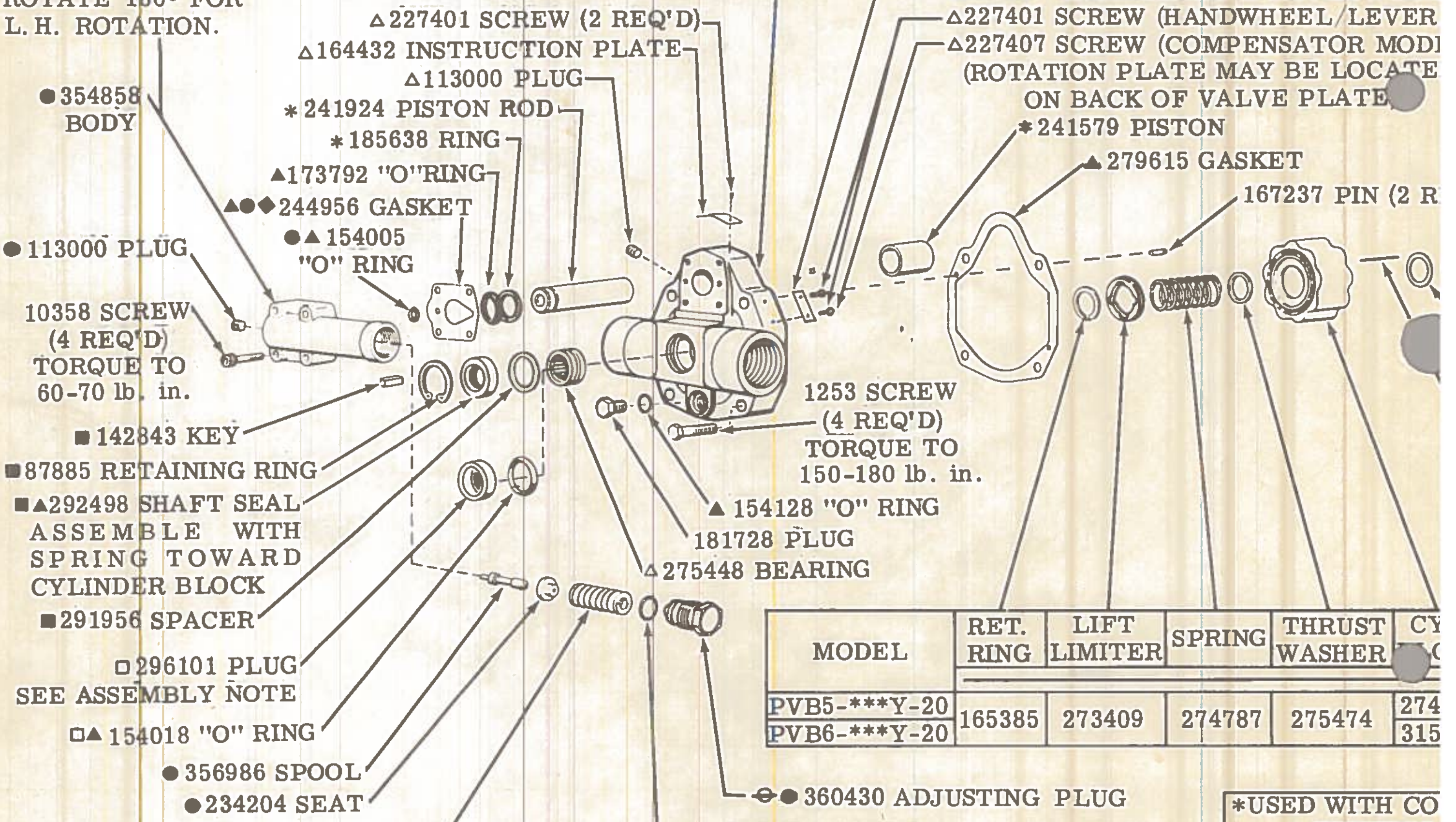
△INCLUDED IN VALVE PLATE S/A

MODEL	VALVE PLATE S/A
PVB*-(F)RD*Y-20-H/M-10	942226
PVB*-(F)LD*Y-20-H/M-10	942247
PVB*-(F)RS*Y-20-C(M)-11	942248
PVB*-(F)LS*Y-20-C(M)-11	942249

SEE PINTLE BEARING

MODEL
PVB*-*S*Y-**-C/

COMPENSATOR POSITION SHOWN FOR R. H. ROTATION. ROTATE 180° FOR L. H. ROTATION.



MODEL	RET. RING	LIFT LIMITER	SPRING	THRUST WASHER	CY
PVB5-***Y-20	165385	273409	274787	275474	274
PVB6-***Y-20					315

*USED WITH CO CONTROL

PRESSURE RANGE (PSI)	COMPEN-SATOR SUBASSY	SPRING
(C)250-3000 (5) ⊖ 250-2000 (6)	942158	●239371
(CM)250-1500	942159	●265693

●INCLUDED IN PRESSURE COMPENSATOR SUBASSYS SHOWN IN TABLE.

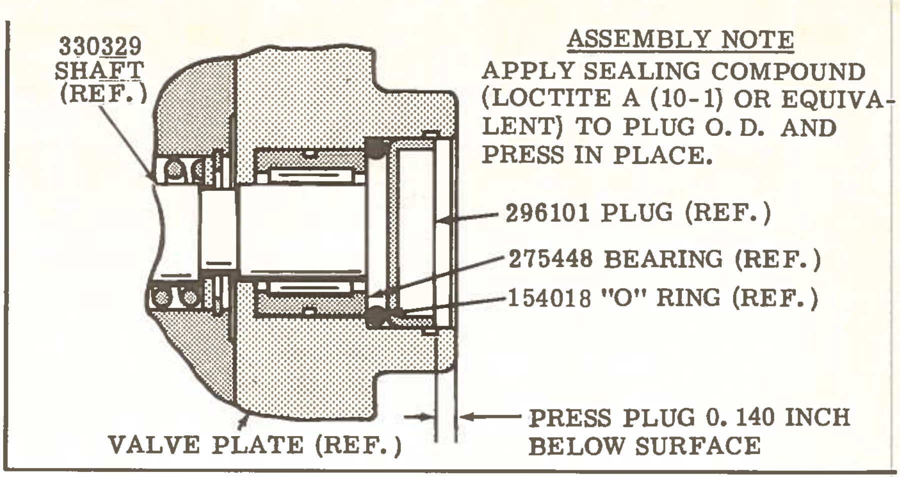
⊖ CAUTION
MODEL PVB6 COMPENSATOR PRESSURE ADJUSTMENT SHALL NOT EXCEED 2000 PSI.

◆NOTE
POSITION GASKET WITH SMALL END OF TEARDROP HOLE IN DIRECTION OF COMPENSATOR ADJUSTING PLUG

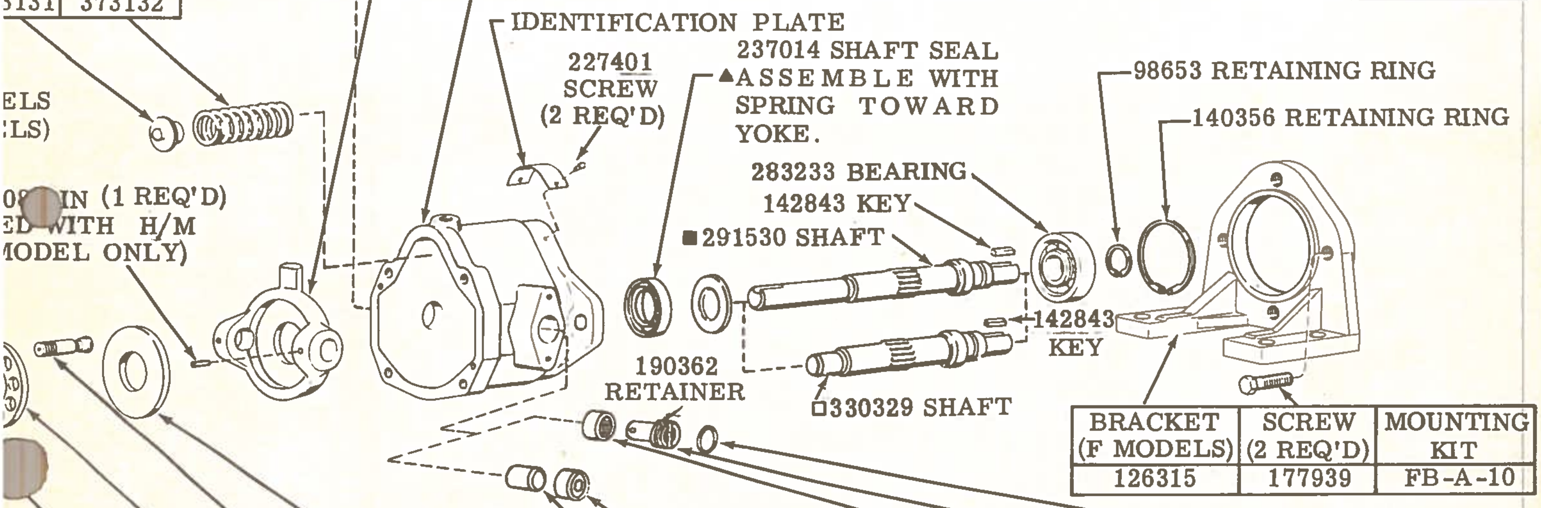
▲INCLUDED IN 919409 SEAL KIT

F3 EQUIVALENT SEAL KIT 920159

MODEL	YOKE	HOUSING
PVB*-*D*Y-20-H/M-10	237192	308334
PVB*-*S*Y-20-C(*)(*)-11	231557	



ASSEMBLY NOTE
APPLY SEALING COMPOUND (LOCTITE A (10-1) OR EQUIVALENT) TO PLUG O. D. AND PRESS IN PLACE.



EAT	*SPRING
3131	373132

BRACKET (F MODELS)	SCREW (2 REQ'D)	MOUNTING KIT
126315	177939	FB-A-10

MODEL	BEARING	CONTROL PINTLE	▲"O" RING
H-10	242222	237191	200088
M-10		237433	

PINTLE	BEARING	MODEL
319243	317572	C/CM

SEE PINTLE BEARING ASSEMBLY NOTE

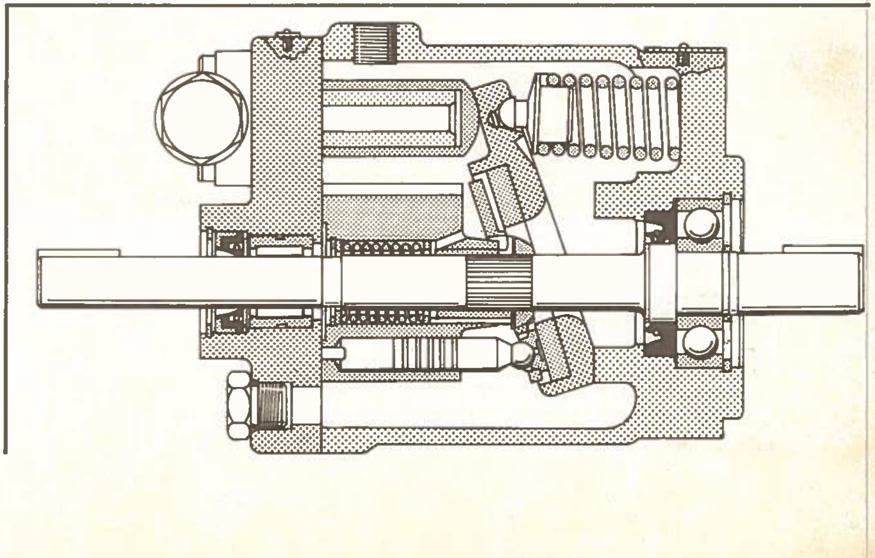
PIN REQ'D)	WASHER	SPHER. WASHER	SHOE PLATE	PISTON S/A KIT	SWASH PLATE	ROTATING GROUP KIT
E PARTS INCLUDED IN ⟶						
248203	274956	275485	274249	942229 942230	319245	938262 938264

SATOR

NOTE: TYPE 'C' & 'CM' COMPENSATOR CONTROL PARTS SHOWN. SEE BACK PAGE FOR MANUAL CONTROLS. REFER TO PARTS DRAWING I-3243-S FOR 'CVP' PRESSURE LIMITING & LOAD SENSING COMPENSATOR CONTROL.

□ USED ON
PVB*-**WY-20-*(*)-1*
SIDE PORT MODELS ONLY

■ USED ON
PVB*-**XY-20-*(*)-1*
THRU SHAFT MODELS ONLY



MODEL CODE BREAKDOWN

PVB * - (F) * * * Y - 20 - * (*) (*) - 1 *

PUMP

VARIABLE DISPLACEMENT

IN-LINE PISTON UNIT

GPM - FLOW RATING AT 1800 RPM
5 - 5 GPM
6 - 6 GPM

MOUNTING
F - FOOT BRACKET
(OMIT FOR FLANGE MOUNT)

ROTATION, VIEWING SHAFT END
R - RIGHT HAND
L - LEFT HAND

SWASH PLATE MOVEMENT
D - BOTH SIDES OF CENTER
S - ONE SIDE OF CENTER

OPTIONAL FEATURES
W - SIDE PORTS
X - SIDE PORTS - THRU SHAFT

SHAFT END
Y - STANDARD

PUMP DESIGN

CONTROL TYPE
PRESSURE COMPENSATOR
C - 250 - 3000 PSI (5 GPM)
250 - 2000 PSI (6 GPM)
CM - 250 - 1500 (5 - 6 GPM)
CVP - PRESSURE LIMITER LOAD SENSING
H - HANDWHEEL
M - LEVER

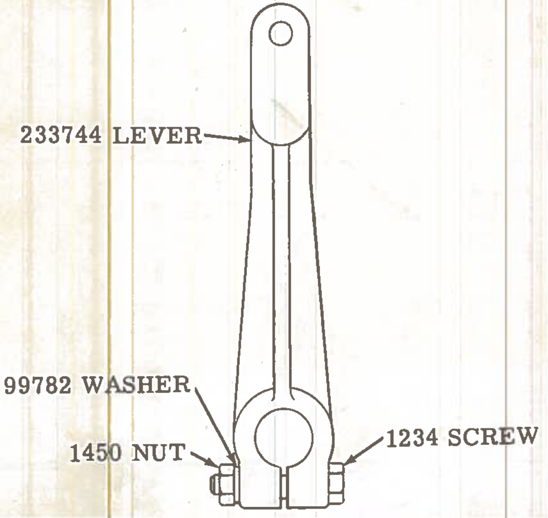
C-ADJUSTABLE MAXIMUM DISPLACEMENT STOP
(PRESSURE COMPENSATED MODELS ONLY)

COMPENSATOR VARIATIONS
D - DUAL-RANGE (ELECTRIC CONTROL 115 VOLTS - 60 CYCLE)
DH - DUAL-RANGE (HYDRAULIC CONTROL)
G - HYDRAULIC REMOTE (L.H. ONLY EXCEPT CCG MODELS)

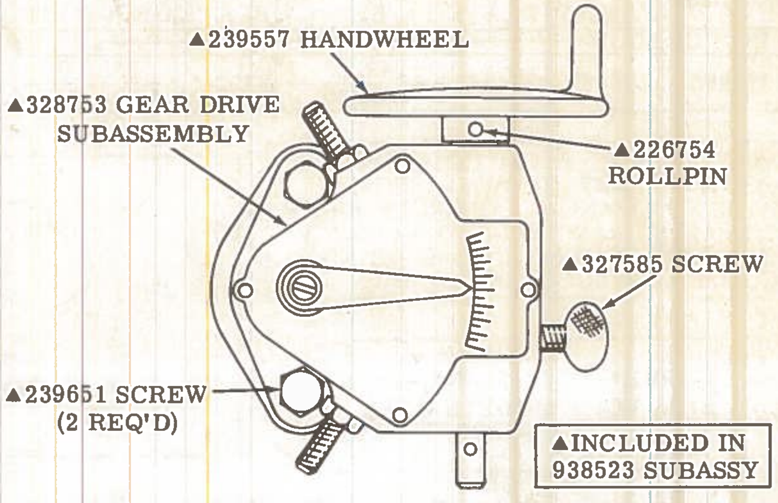
OTHER CONTROL OR OPTIONS
L - LEFT HAND VIEWING SHAFT END (OMIT FOR RIGHT HAND)

CONTROL DESIGN NUMBER

MANUAL LEVER CONTROL
MODEL PVB*-**-20-M-10



HANDWHEEL CONTROL
MODEL PVB*-**-20-H-10



For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

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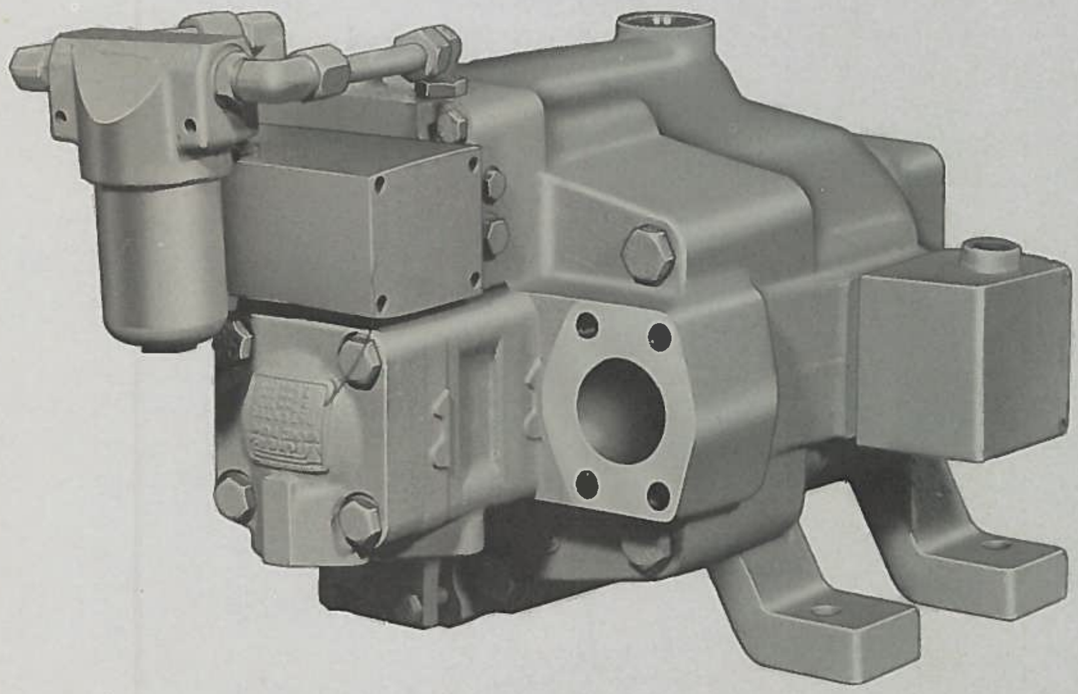
VICKERS®
A TRINOVA COMPANY

Service Parts Information

45 GPM Variable Delivery Inline Piston With Electrohydraulic Servo Control

PVB45-(F)**F-21-RA(A)-11

62



Vickers, Incorporated

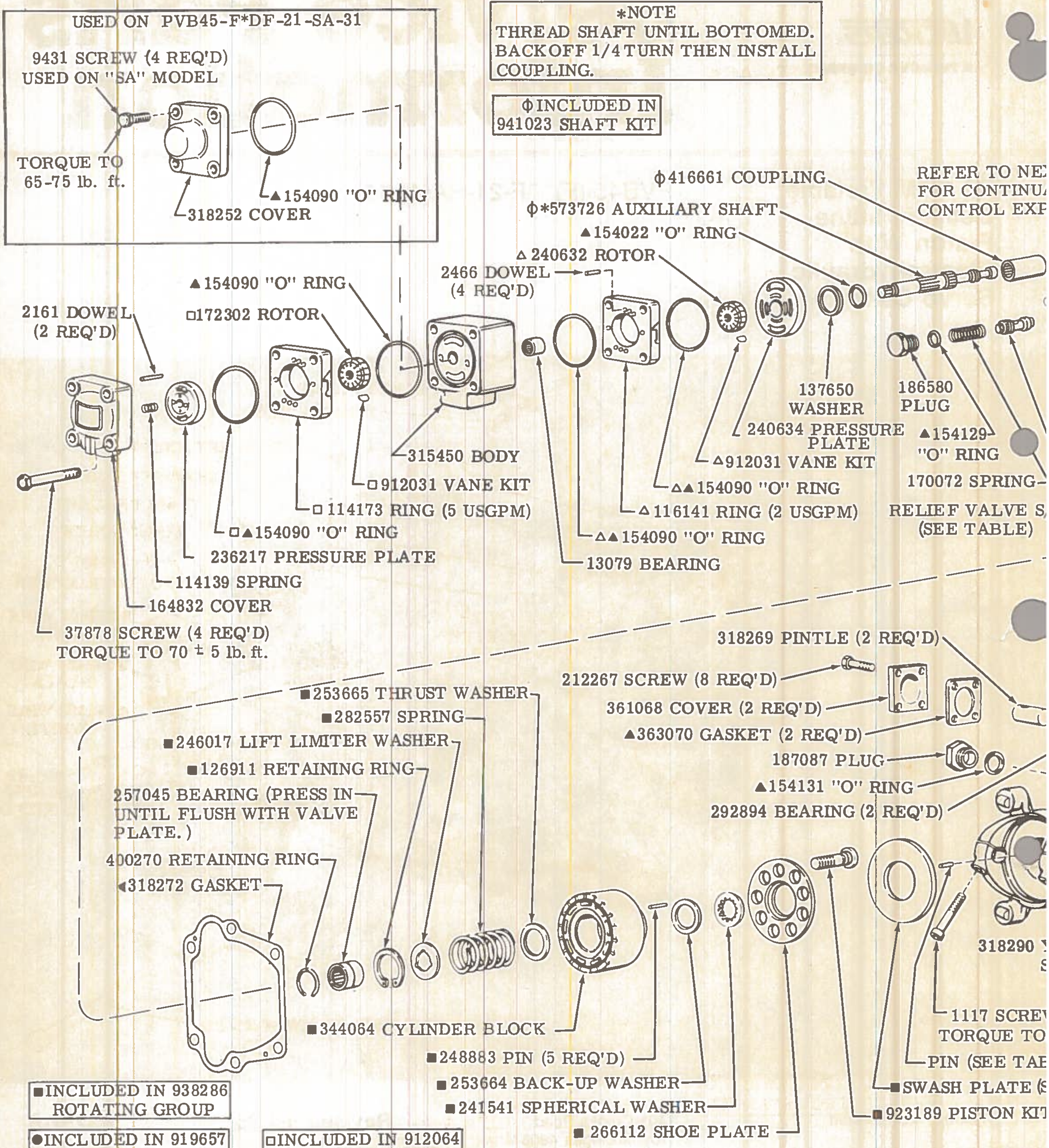
1401 Crooks Road
Troy, Michigan 48084

Revised 9-1-85

I-3257-S

*NOTE
THREAD SHAFT UNTIL BOTTOMED. BACKOFF 1/4 TURN THEN INSTALL COUPLING.

ϕ INCLUDED IN 941023 SHAFT KIT



■INCLUDED IN 938286 ROTATING GROUP

●INCLUDED IN 919657 CONTROL SEAL KIT

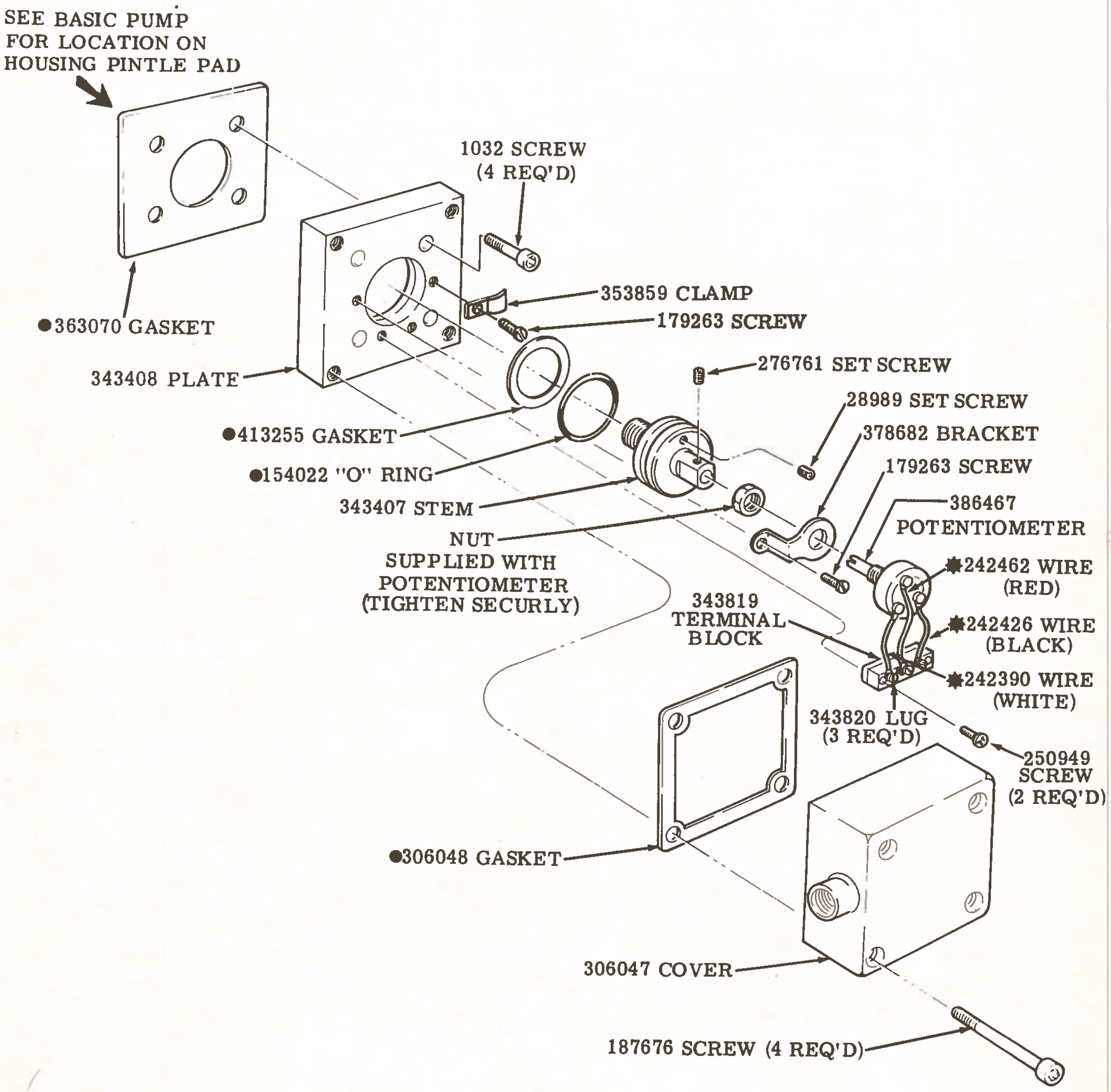
□INCLUDED IN 912064 CARTRIDGE KIT

▲INCLUDED IN PUMP SEAL KIT 919645

△INCLUDED IN 912231 CARTRIDGE KIT

SEE PARTS DRAWING I-3963-S FOR PORT FLANGE DATA

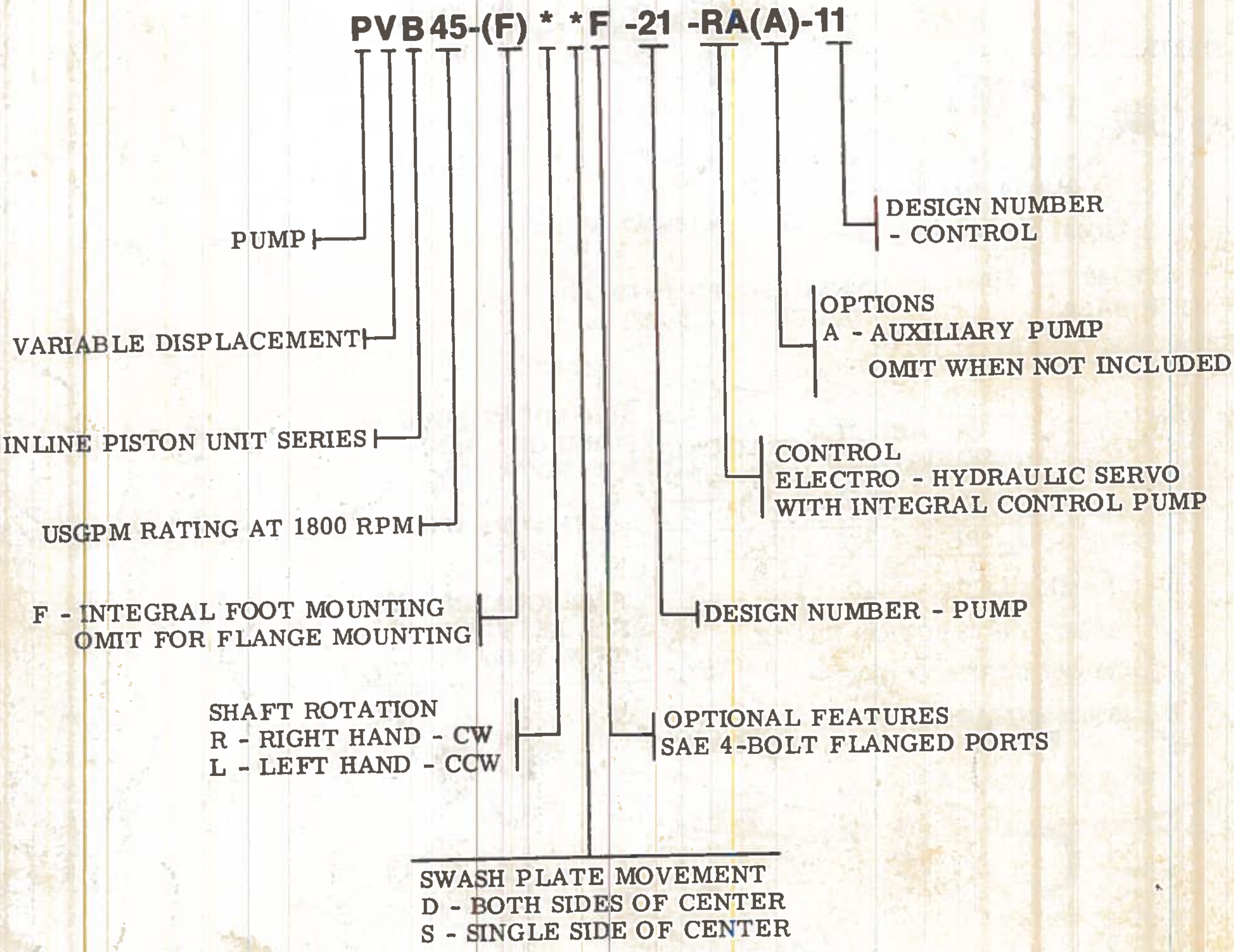
YOKE FEEDBACK



●INCLUDED IN 919838
CONTROL SEAL KIT

✱LEAD WIRES TO BE FOUR (4) INCHES IN LENGTH. THIS ALLOWS POTENTIOMETER TO TURN DURING YOKE FEEDBACK ADJUSTMENT.

MODEL CODE BREAKDOWN



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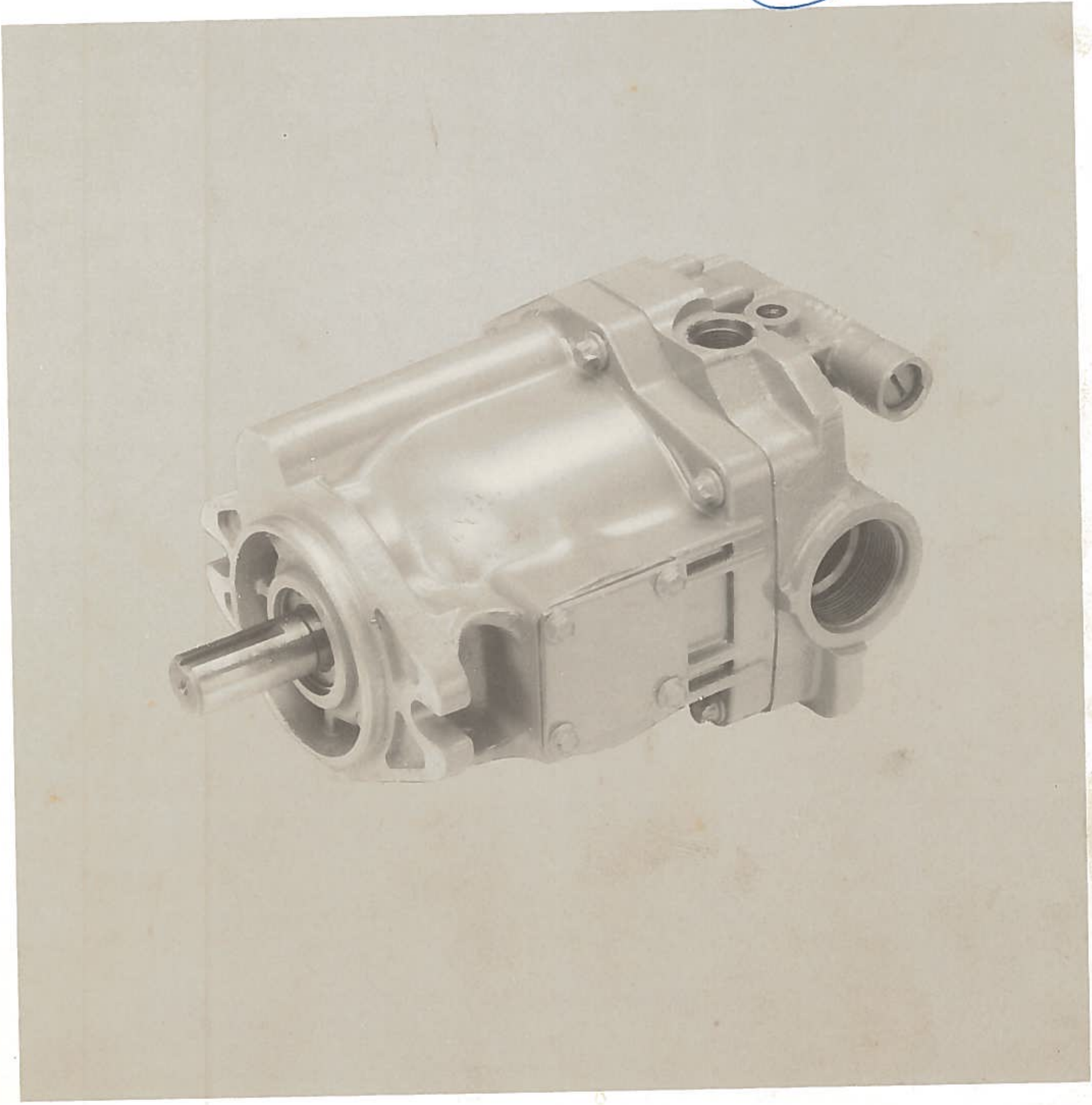
VICKERS

Overhaul Manual

63

PVE Variable Pump
12–21 USgpm capacity at 1800 rpm



Released 8–1–90

M–2854–S

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PVE12 MODEL CODE BREAKDOWN

P V E 12 R – (Q) * *–* *– 10 – C**VPC** – B –12

1 2 3 4 5 6 7 8 9 10 11 12 13 14

1 Pump

2 Variable Displacement

3 Inline Piston Type

E – Series

4 Flow Rating

(USgpm @ 1800 rpm)

5 Shaft Rotation

(Viewed from shaft end)

R – Clockwise rotation
L – Counterclockwise rotation

6 Noise Level Rating

Blank – Standard unit
Q – Industrial quieter 1800 rpm @ 207 bar (3000 psi)

7 Mounting Flange

B – SAE B 2 bolt

8 Input Shaft Type

1 – SAE B Straight keyed
2 – SAE B Splined

9 Port Configuration

E – End ported, SAE O–ring
M – End ported, metric O–ring (per ISO 6149)

10 Shaft Seal

S – Standard shaft seal
N – No shaft seal

11 Design

12 Control Options

(** = Pressure setting in tens of bar)

C** –	Pressure compensator Max. setting 207 bar (3000 psi) Range 02–21 bar
C**VP** –	Pressure & load sensing Pressure compensating (see C**) Load sensing (see CV**)
C**VPC**–	Pressure & load sensing Pressure Compensating (see C**) Load setting 24 bar (350 psi) Range 17–31 bar (251–450 psi)
C**VPD** –	Pressure & load sensing Pressure Compensating (see C**) Load setting 41 bar (600 psi) Range 32–45 bar (451–650 psi)
CC** –	Same as C** except with max. adj. stop
CG** –	Pressure compensation with remote control (see C**)
CD –	Electric dual range compensation
CCD –	Same as CD except with max. adj. stop

13 Control Bleed Down

Blank – C,CC,CG,CD,CCD
B – Bleed down orifice (CVP & CVPC)
P – Plug (no orifice) (CVP & CVPC

14 Control Design

PVE19/21 MODEL CODE BREAKDOWN

P V E ** * – * – ** – C*** – 1* – ***

1 2 3 4 5 6 7 8 9 10

1 Pump

2 Variable Displacement

3 Inline Piston Type

E – Series

4 Flow Rating

(USgpm @ 1800 rpm)

19–19 USgpm
21–21 USgpm

5 Shaft Rotation

(Viewed from shaft end)

R – Clockwise rotation
L – Counterclockwise rotation

6 Input Shaft Type

1 – SAE B Straight keyed
2 – SAE B 15 tooth splined
9 – SAE B 13 tooth spline

7 Pump Design

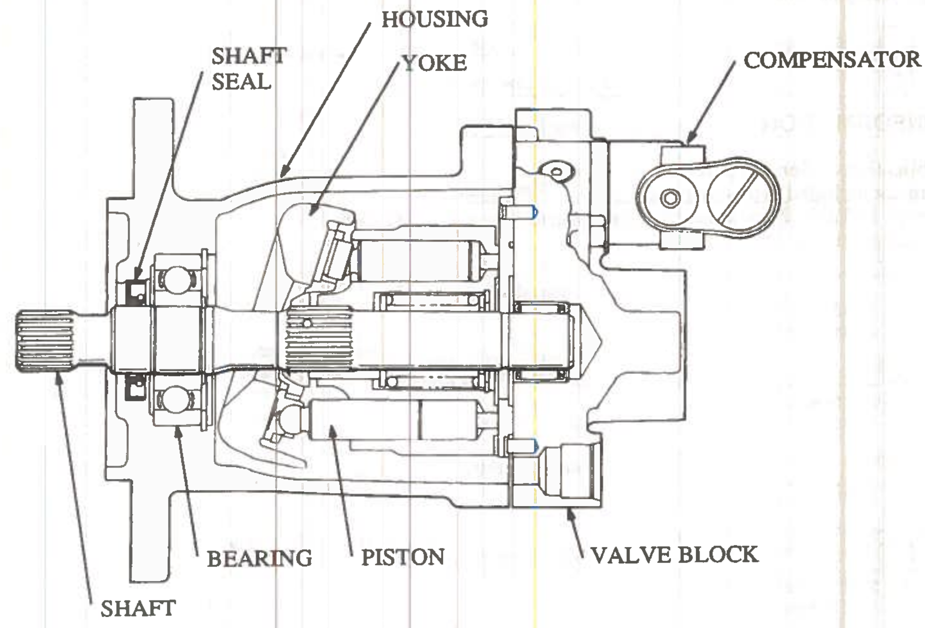
8 Control Options

C–10	Pressure compensated (PVE19, 250–3000 psi) (PVE21, 250–2700 psi)
CG–10	Remote control pressure compensator adjustable from 350–3000 psi using and external relief valve.
CV–10	Load sensing PVE19/21
CVP–12	Load sensing (160 psid) with pressure compensation PVE19/21
CVPC–12	Load sensing (350 psid) with pressure compensation PVE19/21

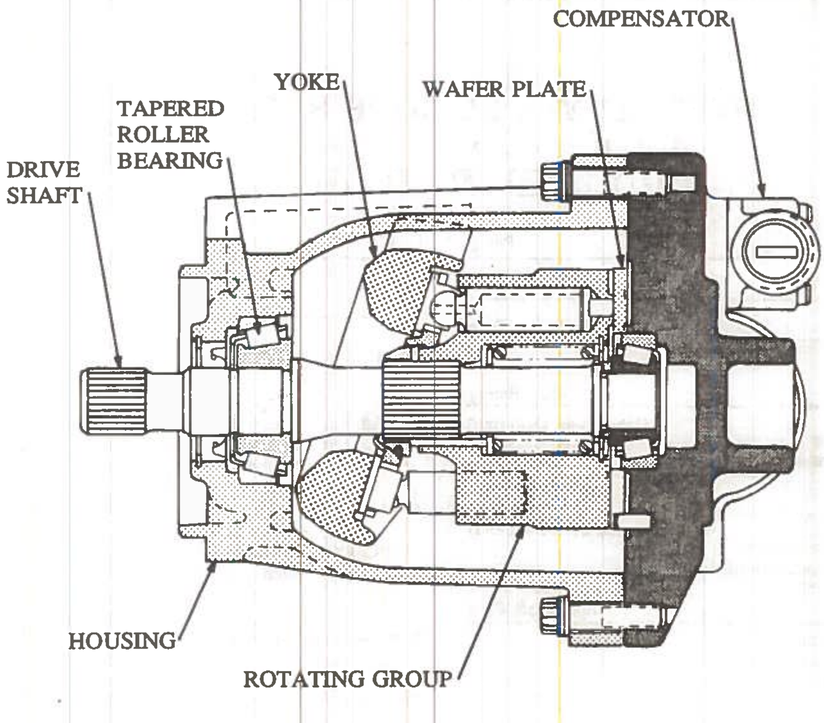
9 Control Design

10 Special Suffix

Table 1. Model Code Breakdown



PVE12 Section View



PVE19 Section View

Figure 1. Sectional Views of the PVE Pumps

Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes operational characteriestics and overhaul information for the PVE12, 19(*) and PVE21(*)–** variable displacement piston pumps. The information contained herein pertains to the latest design series as listed in the Model Code (Table 1.)

B. GENERAL INFORMATION

1. Related Publications – Service parts information and installation dimensions are not included in this manual. The parts and installation drawings listed in Table 2 are available from any authorized distributor or sales engineering office.

2. Model Codes – Variations within each basic model series are covered in the Model Code. Table 1 is a complete breakdown of the codes covering these units. Service inquiries should always include the complete unit model code number as stamped on the mounting flange.

MODEL SERIES	PARTS DRAWING	Installation Information
PVE12	M–2853–G	——
PVE19	M–2841–S	322C
PVE21		

Table 2. Parts & installation literature

Section II – DESCRIPTION

A. GENERAL

Assembly of a typical pump package is shown on page 2 .

Six types of compensator subassemblies are used with the PVE series pumps. Refer to Section III for principles of operation. See Model Code for pressure settings.

1. Compensator (C), (Flat Cut–Off Type): A pump using this compensator will maintain a constant load pressure for all values of flow within the capacity of the pump.
2. Compensator (CG), (Remote Control Type): This compensator is similar to the 'C' type except the compensator is controlled by a remote hydraulic source such as a relief valve.
3. Compensator (CV), (Load Sensing Type): A load sensing compensator provides flow at a pressure equal to that required by the load plus a constant value used as a pressure drop across a metering valve. The pump will change its flow with changes in size of the metering valve orifice. The pump and compensator together provide a constant flow source for the load, at a pressure established by the requirements of the load, hence the title "load sensing."

CAUTION

A relief valve must be provided in the external circuit to prevent excessive pressure build up at the pump.

4. Compensator (CVP), (Load Sensing Pressure Limiting Type): The CVP control is a combination of the standard flat cut–off compensator (C) and the load sensing compensator (CV). The load sensing compensator controls flow to the load across an external valve orifice. If pressure build–up exceeds the flat cut–off compensator setting, the flat cut–off compensator overrides the load sensing compensator and lowers the flow to prevent excessive pressure build–up at the pump.
5. Compensator (CVPC), (Load Sensing, Pressure Limiting Type): This compensator is the same as the 'CVP' compensator except the load sensing spring is heavier. The heavier spring provides a slightly higher pressure differential (160ΔP vs. 350ΔP) across the external valve orifice. See Figure 5.
6. Compensator (CVPD), (Load Sensing, Pressure Limiting Type): Same as 'CVPC' except with higher pressures.

B. APPLICATION

Pump ratings in USgpm as shown in the model code are at 1800 rpm. For ratings at other speeds, methods of installation and other application information, contact an authorized distributor or sales engineer.

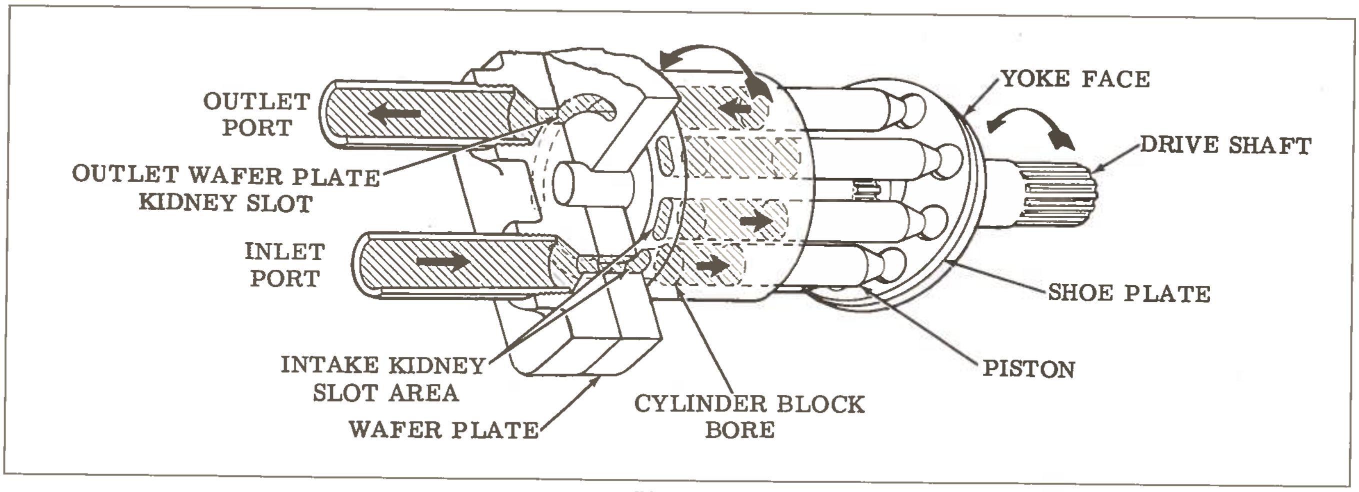


Figure 2

A. PISTON PUMP

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate. See Figure 2. The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face creates a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted wafer plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

B. COMPENSATOR (Flat Cut–Off Type)

A flat cut–off compensated pump will maintain a constant load pressure for all values of flow within the capacity of the pump providing the load is sufficient to build up pressure.

A step–by–step description of the flat cut–off type compensator control follows. Refer to Figure 3 throughout this discussion.

When a no load condition exists, the pump will deliver maximum flow at zero pressure. As the actuator load increases, pressure will rise, however, flow will remain at maximum until pressure reaches the compensator spring setting (cracking pressure). As a further increase in load occurs, system pressure will cause the compensator spool to move against the compensator spring, metering flow to the yoke stroking piston. The yoke stroking piston then moves the yoke to reduce flow. As flow is reduced, system pressure reduces slightly causing the compensator spool to return to the null position. At null, flow to the yoke stroking piston stops. Movement of the yoke will stop and the flow will stabilize at a reduced value. If the load were to continue to increase, the pump flow would reduce to zero and a deadhead pressure condition would exist. The pressure differential needed to cause the compensator spool to change from maximum flow (cracking pressure) to zero flow (deadhead pressure) is approximately 50 to 150 psi.

Pump outlet flow is proportional to the control range from cracking pressure to deadhead pressure i.e. if cracking pressure is 2900 psi (maximum flow) and deadhead pressure is 3000 psi (minimum flow) a pressure of 2950 psi would be equal to half maximum flow.

If the load decreases, pressure will decrease proportionally and the compensator spring will move the spool down, opening the yoke stroking piston to case drain. As fluid is metered from the yoke stroking piston, the yoke spring will stroke the yoke to increase flow. The increase in flow causes a proportional increase in system pressure. The increase in system pressure returns the compensator spool to a null position and flow from the yoke stroking position will stop. Simultaneously, movement of the yoke will stop. The flow will stay constant until another change of load occurs.

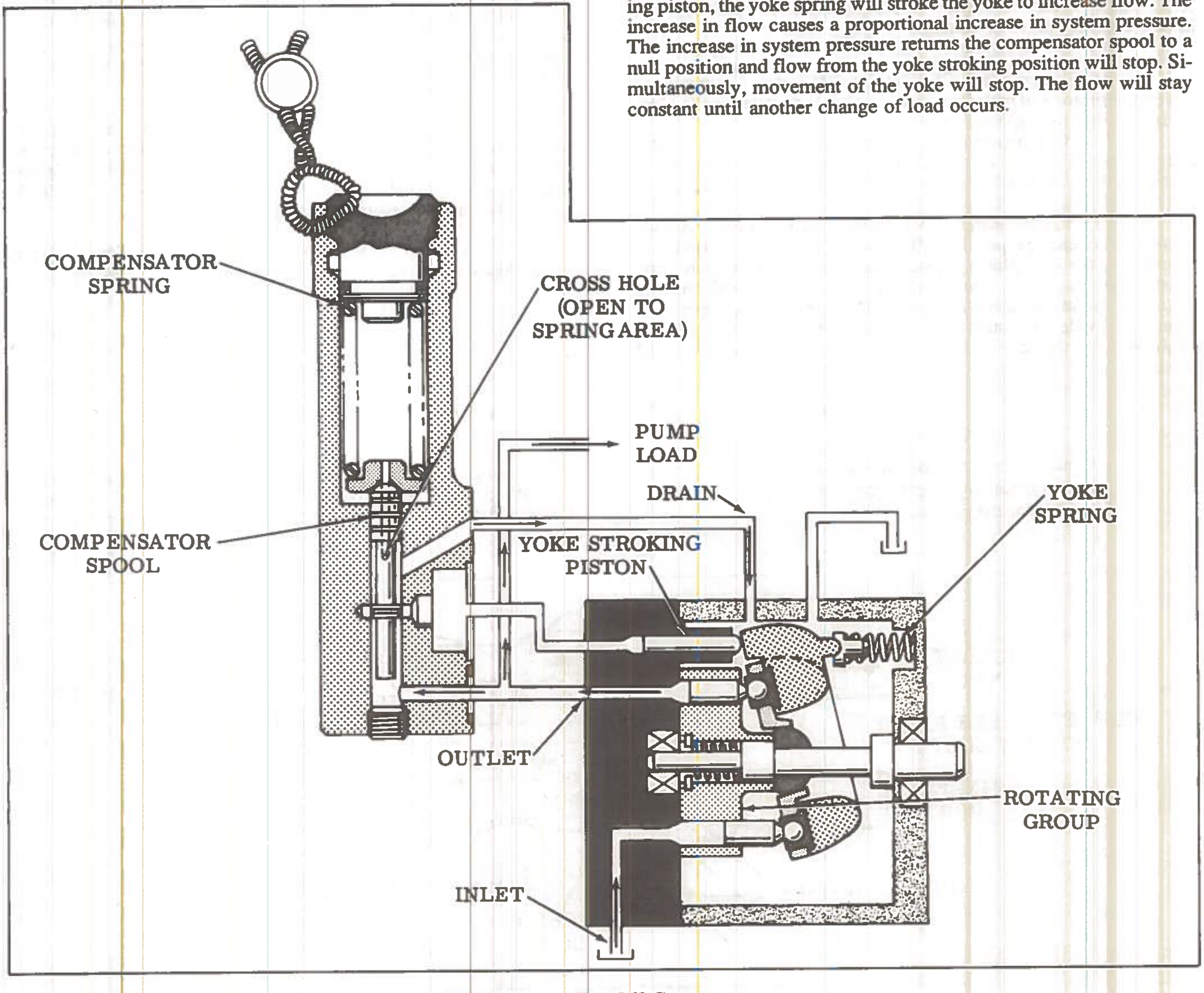


Figure 3. Flat Cut-Off Compensator

If the load continues to decrease, pump flow will continue to increase, holding the outlet at compensator cracking pressure. When maximum flow is reached (max. stroke), a maximum flow and a maximum pressure condition exists. A further decrease in load will lower the outlet pressure until a final theoretical condition of maximum flow and zero pressure is obtained.

C. **COMPENSATOR** (Remote Control - "CG")

This compensator allows the operator to change the pressure setting through the use of a remote control valve. The "CG" compensator has the same performance characteristics as the "C" type compenstor.

D. **COMPENSATOR** (Load Sensing Type - "CV")

APPLICATION.

A frequent application of pressure compensator pumps is to supply sevo valves or mechanically operated metering valves, whose function is to control flow to a hydraulic actuator (cylinder or motor).

In such circuits it is often desirable that flow be proportional only to an external valve spool position. This requires a constant pressure drop across the external valve. (NOTE: Flow through a valve varies with pressure drop as well as with valve spool position.)

Pumps incorporating the load sensing feature have a constant flow characteristic: Flow is constant regardless of the load pressure.

CAUTION

A relief valve must be used to prevent outlet pressure from exceeding pump ratings if the load is excessive.

MINIMUM PUMP PRESSURE.

The minimum outlet pressure developed by the pump (no load) is a function of the compensator spring force versus the yoke spring force, whichever is greater. (Please note that external valve spool position (orifice size), has nothing to do with the minimum outlet pressure of the pump). The orifice size controls pump rate of flow only. The minimum outlet pressure will be constant for all settings of the valve spool orifice and is considered the pressure drop across the orifice (△P).

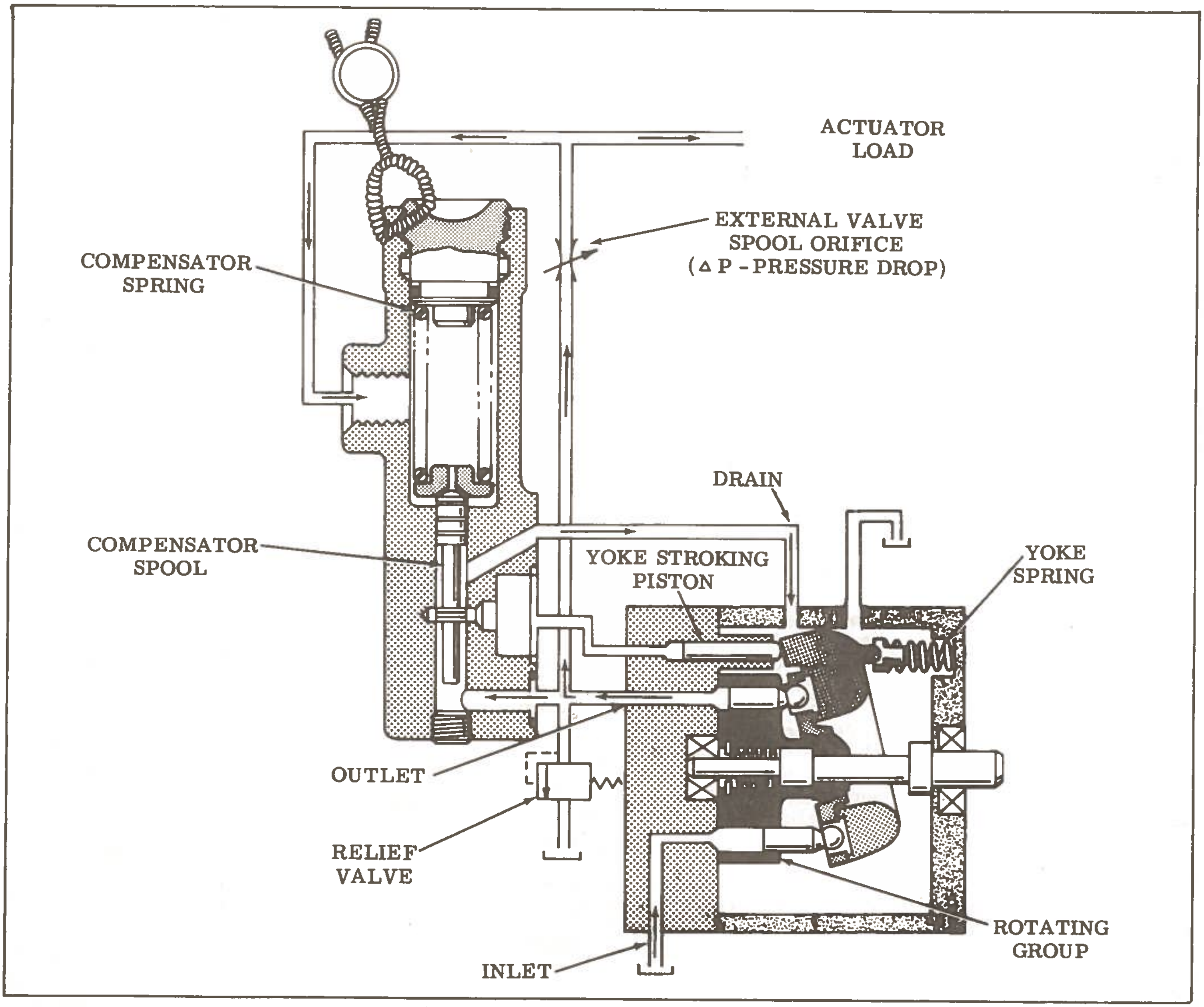


Figure 4. Load Sensing Compensator (CV)

CIRCUIT OPERATION AT MINIMUM PRESSURE.

Refer to Figure 4 during the following description. Assume a no load condition.

The pump load consists of the pressure drop accross the valve spool orifice (△P), plus the pressure developed by the work being performed at the actuator. (In this case the actuator is unloaded and only the pressure drop across the valve spool orifice (△P) will be considered.)

Flow is restricted through the valve spool orifice and develops a pressure at the outlet of the pump. This pressure is applied to the lower end of the compensator spool. Initially, the compensator spring is holding the spool in the down position and the yoke is at maximum delivery position. When the pump is started, the increasing flow increases pressure at the lower end of the compensator spool and the compensator spool opens pressure to the yoke stroking piston. The yoke then strokes to a lower flow, lowering the pressure drop across the external valve orifice. When pressure reaches △P, the compensator spool will null. At this time, the stroking piston will remain stable until the external valve spool orifice is changed. (See Figure 4.)

EXTERNAL VALVE SPOOL ORIFICE SIZE REDUCED.

If the external valve spool orifice is reduced in size, pressure at the pump outlet will rise proportionally causing the compensator spool to move against the compensator spring. When the compensator spool moves far enough to open the yoke stroking piston to pump outlet pressure, the yoke stroking piston will move the yoke to a lower flow setting.

The compensator senses pressure at the downstream side of the external valve spool orifice and compares this pressure to the pump outlet pressure. The compensator then adjusts the yoke to a flow which holds a constant pressure drop (△P) across the external valve spool orifice.

The pressure developed at the pump outlet is a summation of the pressure drop across the external valve spool orifice and the actuator load pressure. As the actuator load pressure increases, the increase is reflected directly back to the pump outlet. Since the compensator monitors the difference between pump outlet pressure and actuator load pressure, and this difference (△P) does not change with load variations, flow from the pump will stay constant.

EXTERNAL VALVE SPOOL ORIFICE SIZE INCREASED.

If the external valve spool orifice size is increased, pump outlet pressure will decrease, lowering force against the compensator spool. (See Figure 4.) The compensator spring causes the spool to move, opening the yoke stroking piston to case drain. As fluid is metered from the yoke stroking piston, the yoke spring force strokes the yoke to a higher flow. The increase in flow through the external valve spool orifice establishes once again the constant pressure drop (△P). With differential pressure (△P) across the external valve orifice, the compenstor spool nulls. Flow from the yoke stroking piston stops, and the pump flow rate stabilizes at a higher value.

Operation of the load sensing compensator is such that as the load pressure varies, the pump outlet pressure will follow the variations, holding a constant pressure drop (△P) across the external valve spool orifice, and a constant flow through the external valve and actuator. Pump flow will change only with changes in external valve spool orifice size.

E. COMPENSATOR – Load sensing with pressure limiting CVP, CVPC or CVPD

As expected from the above title, these units are a combination of the flat cut–off and load sensing compensators.

The load sensing portion functions at pressures below the flat cut-off compensator setting and provides a constant flow characteristic. If pressure exceeds the flat cut-off compensator setting, the yoke will stroke to zero flow at maximum pressure lowering the horsepower requirements for holding circuits and protecting the pump. Refer to Figure 5 throughout the following circuit explanation.

Assume an actuator load that is increasing gradually. Also, assume the pump outlet pressure is lower than the flat cut-off compensator cracking pressure. As actuator load pressure increases, the load sensing compensator spool senses the difference between pump outlet pressure and actuator load pressure. As long as the difference between the pump outlet pressure and the actuator load pressure (△P) is constant, flow to the load will stay constant. As pressure rises across the load, leakage will increase in the pump and load. The load sensing portion of the compensator adjusts pump outlet flow to compensate for leakage while providing a constant flow through the valve spool orifice.

The pump outlet pressure continues to increase until the flat cut-off compensator spool reaches cracking pressure. The flat cut-off compensator spool then meters flow to the yoke stroking piston. The yoke stroking piston starts moving the yoke to reduce flow while holding the outlet pressure at compensator cracking pressure. This action continues until the pump is fully compensated (zero flow and maximum pressure).

STANDBY OPERATION FEATURE.

Standby defined: When the external valve spool is shifted to zero flow, the circuit is placed in standby (See Figure 5.).

The small fixed orifice located in the compensator body provides a decompression feature for the load circuit during standby operation. The decompression feature allows the pump to stroke to zero flow and minimum pressure (△P), if the load is blocked and the external valve spool orifice is closed. (Refer to Figure 5.)

The circuit functions as follows:

Assume the pump is at zero flow with maximum pressure to the load. The flat cut-off compenstor spool will be in the up position (compressing the spring) and the load sensing spool will be in the down position due to actuator load pressure plus the spring force. If the external valve spool orifice is closed at this time, fluid under pressure will be trapped in the load circuit and will hold the load sensing spool in the down position. This will keep the pump outlet pressure at flat cut-off compensator cracking pressure (a power loss since no work is being performed at this time). To prevent this condition from continuing, the small orifice meters the fluid trapped in the load back through the flat cut-off compenstor spool to case drain. The actuator load pressure will decrease gradually causing the load sensing spool to open pressure to the yoke stroking piston, bypassing the flat cut-off compensator. As the actuator load pressure reduces, the pump outlet pressure will reduce until minimum pump pressure is obtained. When the minimum flow/minimum pressure condition occurs, the pump is considered to be in standby. During standby, the CVP(C) control reduces the input power well below that of a standard ''C'' type compensator. This provides an increase in system efficiency and reduces the cost of operation.

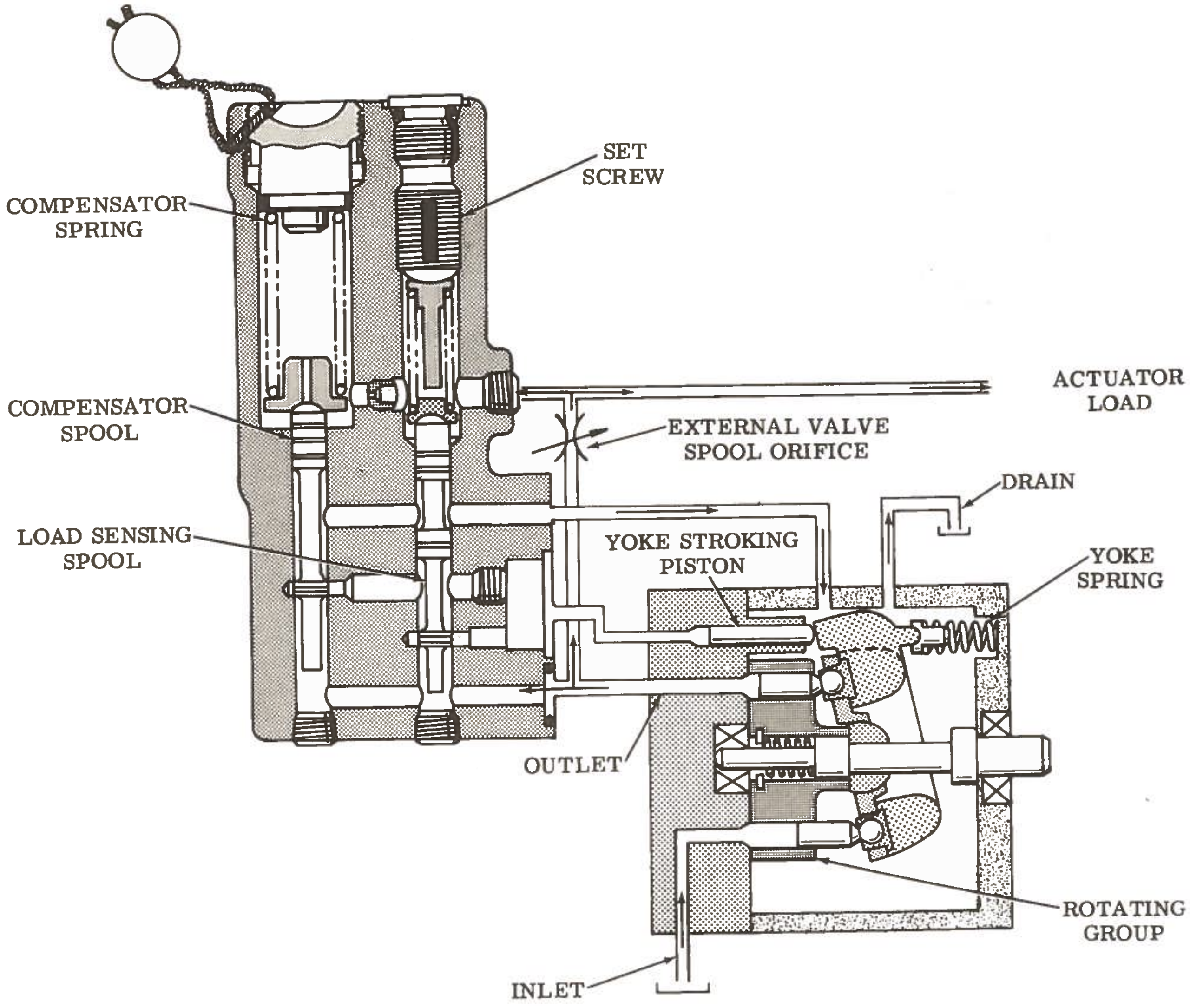


Figure 5. Load Sensing Pressure Limiting Compensator (CVP, CVPC or CVPD)

Section IV – INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawings listed in Table 2 will show installation dimensions and port locations.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION
Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawing. (See Table 2.)

1. Direct Mounting - A pilot on the pump mounting flange (Figure 6) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is NOT recommended for these pumps without engineering approval.

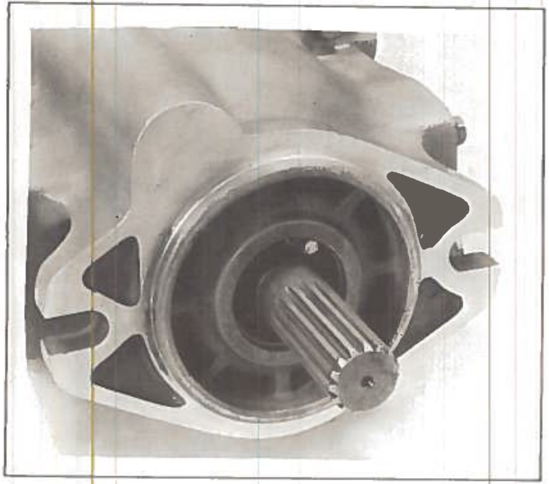


Figure 6. Pump Pilot Flange

C. SHAFT ROTATION

Rotation is determined as viewed from the shaft end of the pump. A pump made for left–hand rotation is identified by and "L" and right–hand by an "R" in the model code. (See Table 1.) An arrow stamped on the mounting flange indicates the correct rotation.

CAUTION
Never drive a pump in the wrong direction of rotation. Seizure may result necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing and pickling.

NOTE
For instructions on pickling, refer to instruction sheet 1221-S

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulance and friction of oil flow. Tubing must not be bent too sharply. The recommended radius for bends is three times the inside diameter of the tube.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheets for oil selection are available from any authorized distributor or sales engineer.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended oils or operating conditions, contact your local distributor or sales engineer.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination, by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of oil filters, breathers, reservoirs, etc. cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design to insure that aeration of the oil is kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in hydraulic systems are:

1. Very high viscosities at start-up temperatures can cause noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings, or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Relief valves limit pressure in the system to a prescribed maximum and protect components from excessive pressure. The setting of the relief valve depends on the work requirements of the system components.

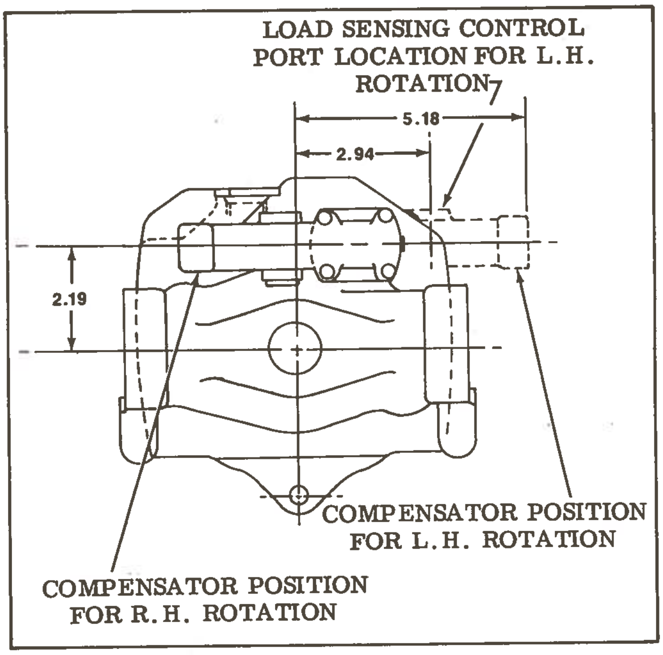

LOAD SENSING CONTROL PORT LOCATION FOR L.H. ROTATION
5.18
2.94
2.19
COMPENSATOR POSITION FOR L.H. ROTATION
COMPENSATOR POSITION FOR R.H. ROTATION

Figure 7. C/CV/CVP Compensator Positions For Right and Left Hand Shaft Rotation

START-UP

Before starting pump the case MUST be filled with clean hydraulic fluid.

With a minimum drive speed of 650 rpm, a pump should prime almost immediately if provision is made to initially purge the air from the system.

Failure to prime within a reasonable length of time may result in damage due to lack of lubrication. Inlet lines must be tight and free from air leaks. However, it may be necessary to crack a fitting on the outlet side of the pump to purge trapped air.

Section V – SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following tools for overhauling the piston pump are shown in Figure 8.

1. Torque wrench with short extension and sockets.
2. 1″ micrometer.
3. 1″ depth micrometer.
4. External Truarc pliers.
5. Internal Truarc pliers.

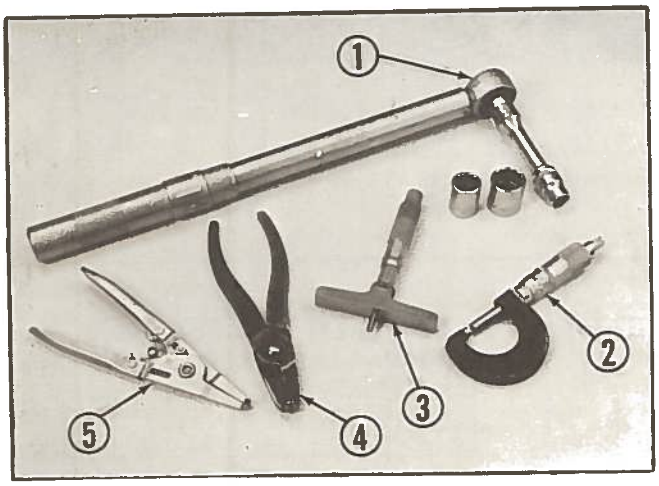
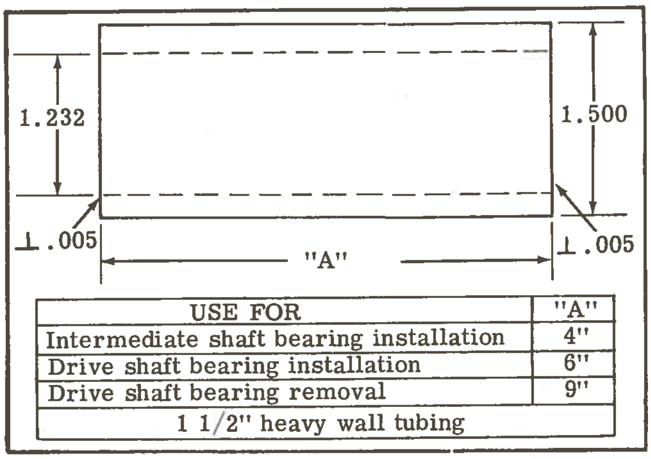


Figure 8. Standard Tools

In addition to the above tools, an arbor press is required to service bearings, etc. Maintenance of this unit is intricate and should not be attempted without the proper tools.

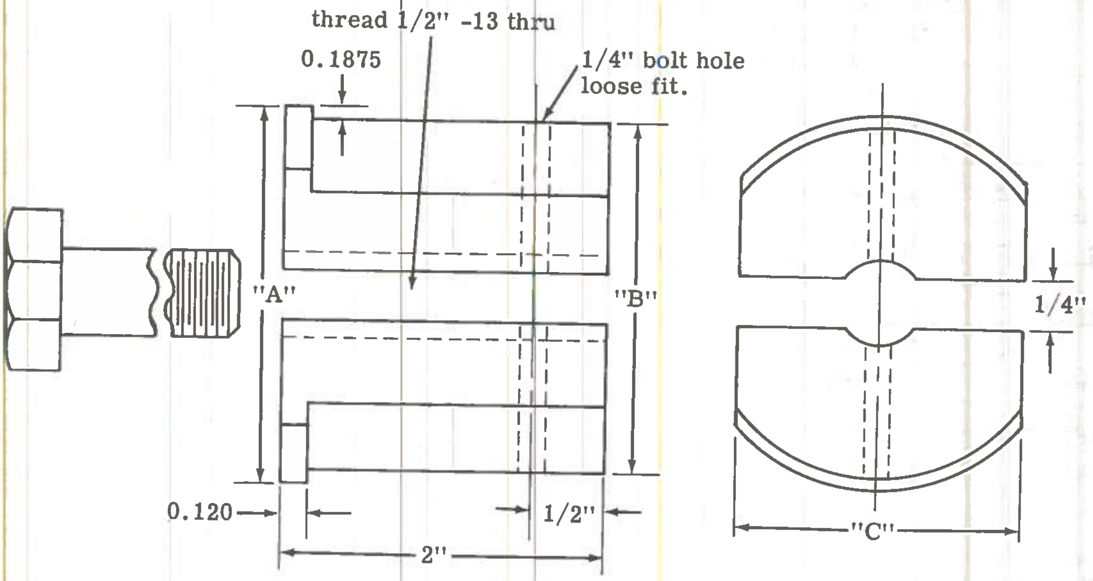
SPECIAL TOOLS

Special tools are shown in Figures 9, 10, 11 and 12.



USE FOR	"A"
Intermediate shaft bearing installation	4"
Drive shaft bearing installation	6"
Drive shaft bearing removal	9"
1 1/2" heavy wall tubing	

Figure 9. Special Shaft Bearing Removal and Installation Tools



Bearing Race Puller

Description	A	B	C
Valve Block	1.675	1.300	1.250
Housing	2.125	1.625	1.500

Use a 5" long 1/2" -13 hex head screw with this tool.

Figure 10. Bearing Race Removal Tools

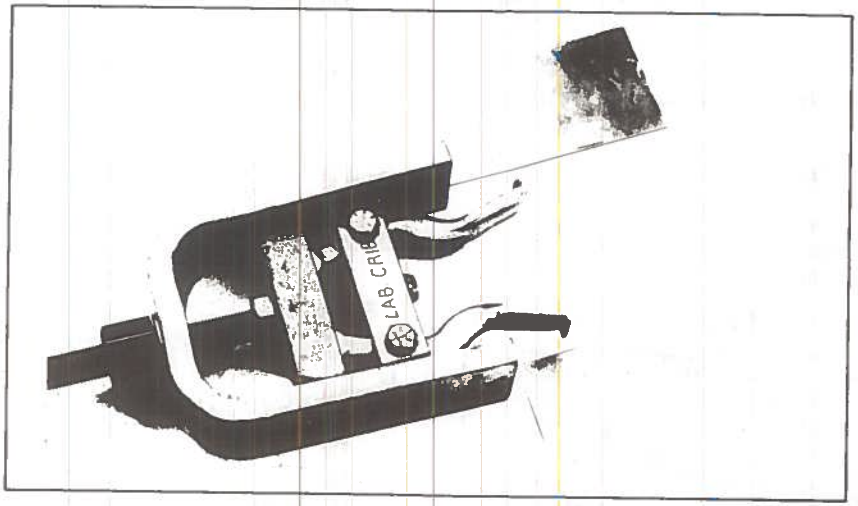
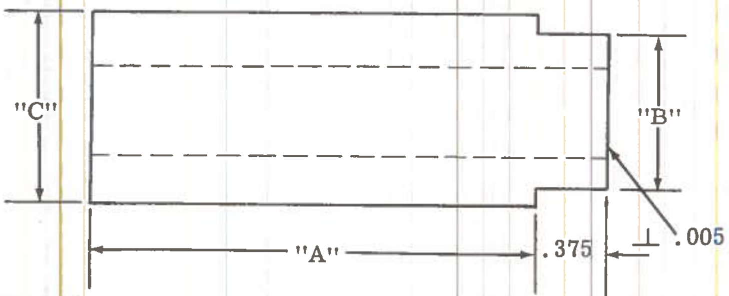


Figure 10a. Valve Block Bearing Race Removal Tool and Shim Stock



NOMINAL PIPE SIZE	"A"	"B"	"C"
1 1/2"	4"	1.625	1.900
2"	4"	2.125	2.375
SCHEDULE 80 (extra heavy)			

Figure 11. Special Bearing Race Installation Tools

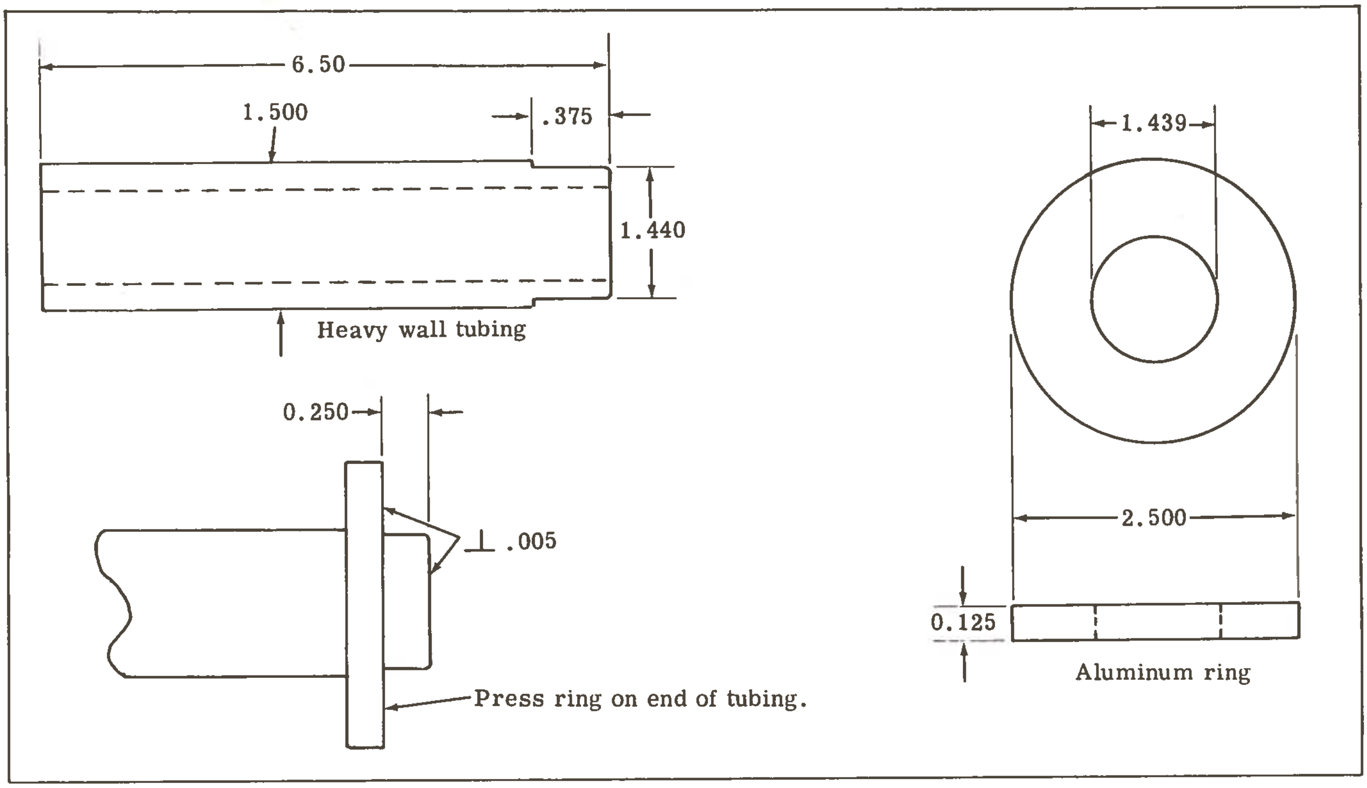


Figure 12. Shaft Seal Driver

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher than normal pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. (See Table 3.)

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be pumped through a 10 micron (absolute) or better filter.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

F. REPLACEMENT PARTS

Reliable operation through the specified operating range is assured only if genuine manufacturer's parts are used. Sophisticated design processes and materials are used in the manufacture of these parts. Substitutions may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. TROUBLESHOOTING

Table 3 lists the common difficulties experienced with piston pumps and hydraulic systems. It also indicates probable causes and remedies for each of the troubles listed.

TROUBLE	CAUSE	REMEDY
I. Excessive pump noise.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended transmission fluid. DO NOT overfill.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream while system is under pressure.
	Vacuum condition.	1. Check inlet lines and fitting for air leaks. 2. Check auxiliary pump function.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Pump overheating.	Internal leakage.	If established that excessive internal leakage exists, return vehicle to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Relief valve open. Compensator misadjusted.	Replace or repair.
	Loss of fluid internally (slippage).	Return vehicle to maintenance shop for repair of hydraulic system.
IV. Loss of fluid.	1. Ruptured hydraulic lines. 2. Loose fittings. 3. Leaking gaskets or seals in pump or circuit.	1. Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose. 2. Observe mating sections of pump for leaks. Replace seals or gaskets if possible.
V. Miscellaneous.	1. Sheared shaft key. 2. Disconnected or broken drive mechanisms.	Locate and repair.

Table 3. Troubleshooting Chart

Section VI – OVERHAUL

GENERAL

CAUTION
Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure.

After removing the pump from the system and before disassembly, cap or plug all ports and disconnected hydraulic lines. Clean the outside of the unit thoroughly to prevent entry of dirt into the system.

CAUTION
Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Periodic maintenance of the pump will generally not require disassembly to the extent described here. However, the sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figure 13. Special procedures are included in the following steps.

NOTE
Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

A. DISASSEMBLY

REMOVAL AND DISASSEMBLY OF THE COMPENSATOR S/A.

a. Remove four screws (1) that hold the compensator S/A to valve block (26) and pull the compensator away from the valve block.

b. Remove compensator gasket (2) and "O" ring (3) from body (11) of compensator S/A.

c. Remove lockwire (4), plug (5) and "O" ring (7) (6 and 7 on the CV compensator).

d. Remove spring (8), seat (9) and spool (10) from the compensator body (11) and set aside for inspection.

e. DO NOT remove plug(s) (24) unless it is necessary for inspection of the bore.

NOTE
The following steps concern only the CVP and CVPC compensator S/A.

f. Unscrew plug (12) and remove parts (13) through (18).

g. Remove plug (19) to gain access to orifice plug (20). Remove orifice plug (20). Do not remove check valve S/A (21) from body (11). Item (20) may or may not be an orifice. If the circuit has a bleed down, orifice (20) may be a plug.

h. Remove plug (22) and "O" ring (23).

i. Remove plug(s) (24) only if necessary to inspect the spool bore.

NOTE
All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts, using a commercial solvent that is compatible with system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning spool, compensator body and valve block passages.

B. INSPECTION REPAIR AND REPLACEMENT

NOTE
Replace all parts that do not meet the following specifications.

1. Inspect all components for excessive wear, erosion and/or seizure.

2. Inspect plugs (5), (12), (19), (20), (22) and (24) for damaged threads, burrs, etc. Make sure orifice hole is open in plug (20). Replace if defective.

3. Inspect spring (8) and (16) for wear and parallelism. Spring ends must be parallel. Replace if spring is warped or wear is evident.

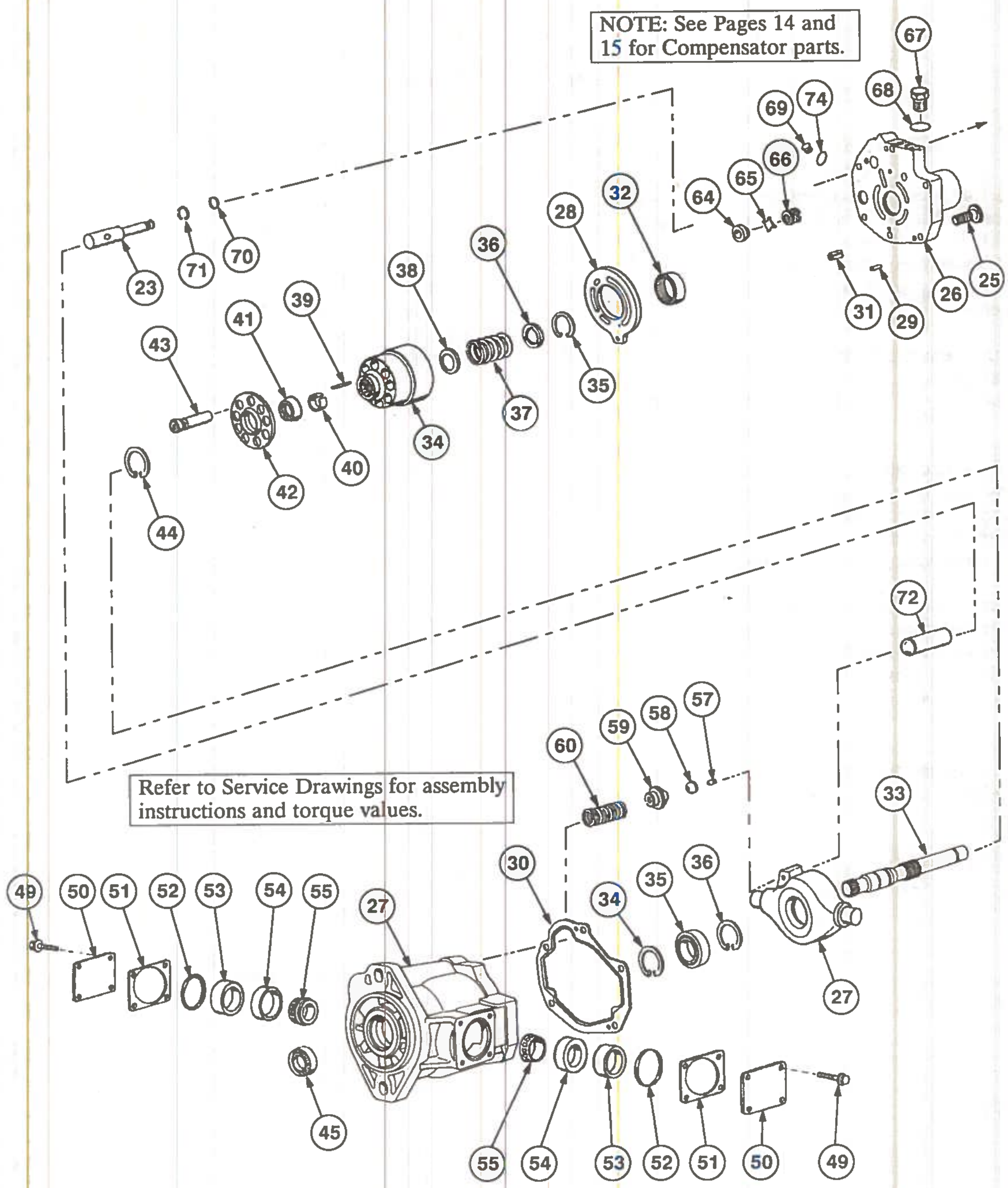
4. Inspect seat (9) for wear in the area of spool contact.

5. Inspect spool (10) for excessive wear, galling, scratches, etc. If scratches exist across the spool land, replace the spool and inspect the body bore. Rotate the spool while moving in and out of the bore to check the binding. Binding cannot be tolerated. If binding is evident, use an India stone to break the sharp edges of the balancing grooves. Use 500 grit paper lightly on the outer surface of the spool. Clean in solvent and lubricate, then try the bind test again. If binding still persists, replace the spool and/or body.

6. Inspect the screws for damaged threads. Replace all damaged threads. Replace all damaged screws.

NOTE
The following step pertains to the CVP or CVPC compensator S/A.

7. Inspect the load sensing section of the CVP compensator as follows:



NOTE: See Pages 14 and 15 for Compensator parts.

Refer to Service Drawings for assembly instructions and torque values.

ITEM	DESCRIPTION	QTY
70	O–ring	1
71	Retaining Ring	1
25	Screw	5
67	Plug	1
68	O–ring	1
69	Plug	1
74	O–ring	1
29	Pin	2
64	Seat	1
65	Valve	1
66	Spring	1
31	Pin	2
32	Bearing	1
26	Valve Block	1
28	Valve Plate	1
30	Gasket	1

ITEM	DESCRIPTION	QTY
27	Housing	1
73	Piston Rod	1
72	Piston	1
43	Piston & Shoe S/A	9
42	Shoe Plate	1
41	Spherical Washer	1
40	Pin Retainer	1
39	Pin	3
35	Retaining Ring	1
36	Spring Washer	1
37	Spring	1
38	Spring Washer	1
34	Cylinder Block	1
49	Screw	8
50	Cover	2

ITEM	DESCRIPTION	QTY
51	Shim	2
52	O–ring	2
53	Spacer	2
54	Bearing Race	2
55	Bearing	2
56	Yoke	1
57	Roll Pin	1
58	Seat	1
59	Seat	1
60	Spring	1
44	Retaining Ring	1
48	Shaft	1
47	Retaining Ring	1
61	Bearing	1
47	Retaining Ring	1
45	Shaft Seal	1

Figure 13. PVE12 Exploded View

PVE19/21

ITEM NUMBER	DESCRIPTION	QUANTITY PER UNIT
1	Screw	4
2	♦ Gasket	1
3	♦ O Ring	1
4	Lockwire and Seal	1
5	Adjusting Plug	1
6	♦ Back–Up Ring	1
7	♦ O Ring	1
8	Spring (pressure limiter)	1
9	Seat	1
10	Spool (pressure limiter)	1
11	Body (compensator)	1
12	Plug	1
13	♦ O Ring	1
14	Adjusting Screw	1
15	Seat	1
16	Spring (load sensing)	1
17	Seat	1
18	Spool (load sensing)	1
19	Plug	1
20	Orifice Plug	1
21	Check Valve S/A	1
22	Plug	1
23	♦ O Ring	1
24	Plug	2
25	Screw	6
26	Valve Block	1
27	Housing	1
28	Wafer Plate	1
29	Pin	1
30	♦ Gasket	1
31	Roll Pin	2
32	Bearing	1
33	Bearing Spacer Kit	1
34	Cylinder Block	1
35	Retaining Ring	1
36	Washer (notched)	1
37	Spring	1
38	Washer (pin)	1
39	Pin	3
40	Pin Retainer	1
41	Spherical Washer	1
42	Shoe Plate	1
43	Piston & Shoe Subassembly	9
44	Retaining Ring	1
45	Shaft Seal	1
46	Shaft Key	1
47	Retaining Ring	1
48	Shaft	1
49	Screw	4
50	Pintle Cover	2
51	Shims (kit)	1
52	♦ O Ring	2
53	Bearing Spacer	2
54	Bearing Race	2
55	Bearing	2
56	Yoke	1
57	Roll Pin	1
58	Seat	1
59	Seat	1
60	Spring	1
61	Bearing (shaft)	1
62	Bearing Race	1
63	Bearing Race	1
64	Seat (check valve)	1
64	Check Valve	1
66	Spring (check valve)	1
67	Plug	1
68	♦ O Ring	1
69	Plug	1
70	♦ O Ring	1
71	Snap Ring	1
72	Piston	1
73	Piston Rod	1

♦ NOTE

Indicated parts included in seal kit. Refer to parts drawing tabulated in Figure 2 for seal kit number and parts information.

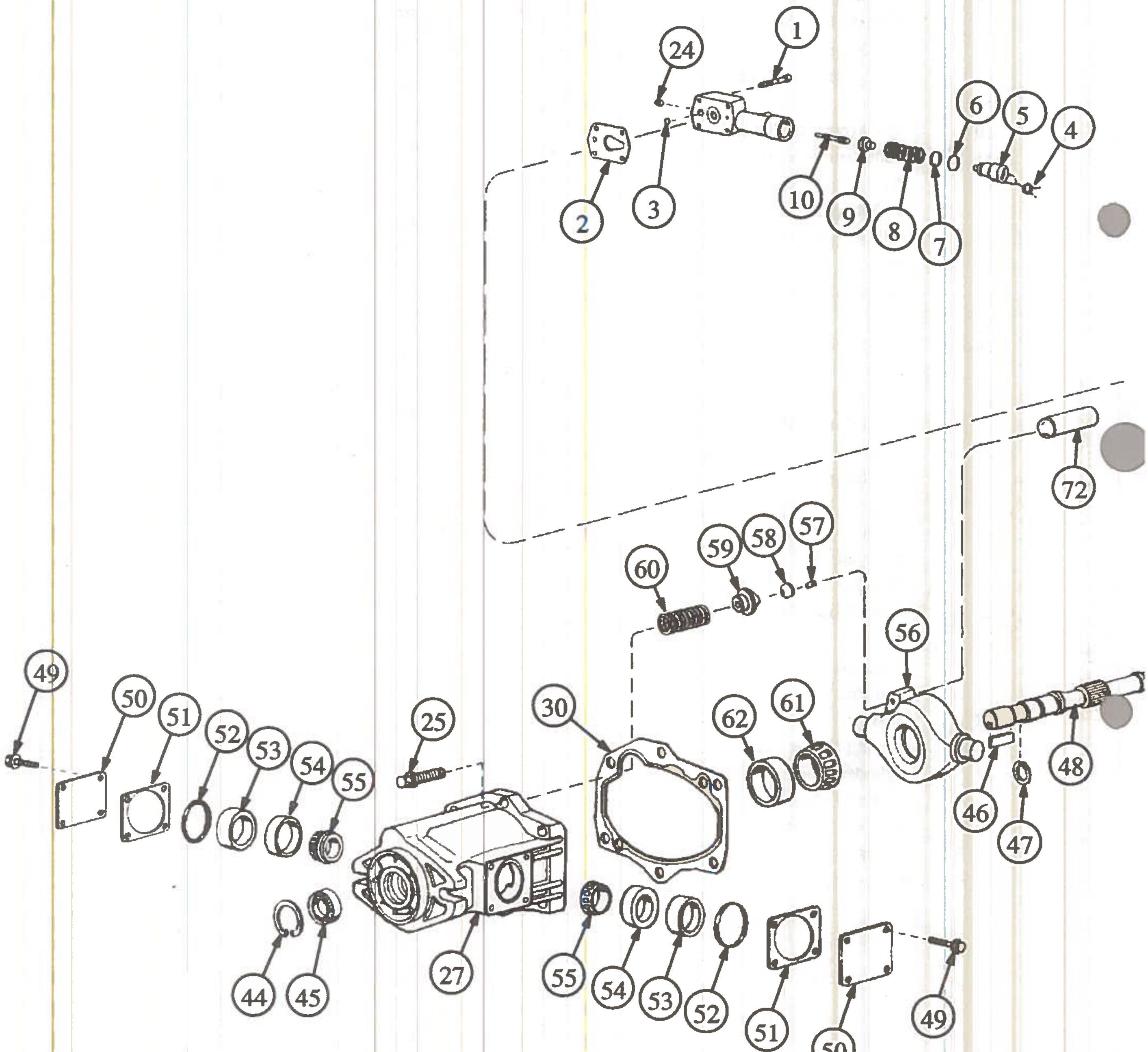
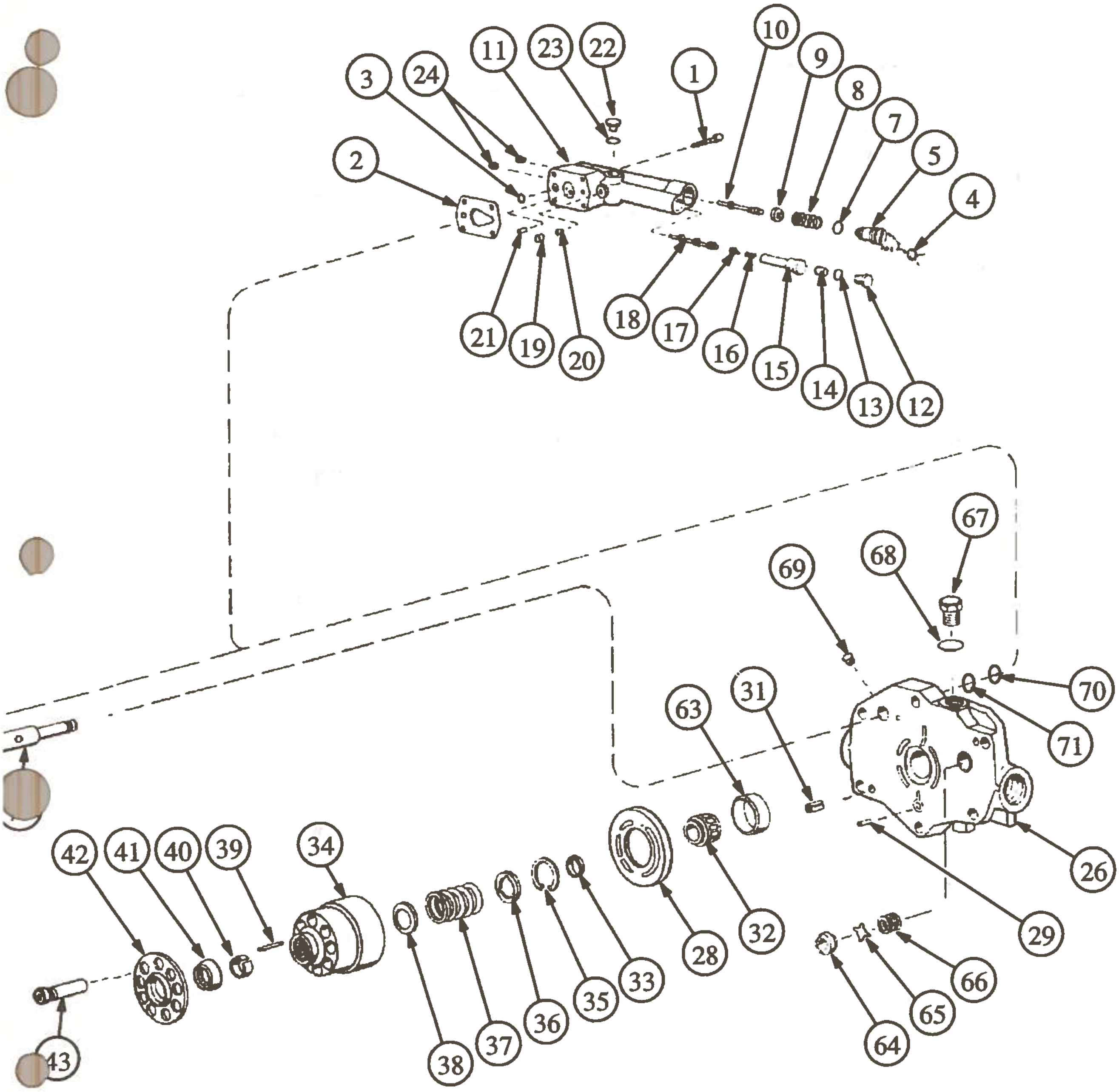


Figure 13. PVE19/21 Exploded View



a. Inspect the load sensing section of the CVP compensator if wear is evident. Clean up burrs with an India stone.

b. If wear is evident, replace the part. Note: After assembly the compensator must be readjusted to the correct pressure. Refer to the test procedure Section VII for instructions on compensator adjustment.

c. Discard adjusting screw (14). Check seat (17) and spool (18) for wear. Refer to step B.5 for procedure when checking the pressure limiting spool.

d. Inspect body S/A (11) bores for scratches. Make sure the orifice plug (20) opening is clear.

C. ASSEMBLY OF COMPENSATOR

Replace the gaskets and "O" rings removed from the unit with those supplied in the seal kit. DO NOT use grease to hold the seals in place. Use a viscosity improver (STP or equivalent). Flood all parts with system fluid to provide initial lubrication and prevent seizure. Assembly of the parts will be in the reverse numerical sequence. Special procedures are included in the following steps.

NOTE
The following step refers to the CVP or CVPC compensator only.

1. Install parts (24) through (22) into body (11).

a. Install parts (20), (19) and spool (18). Make certain the spool does not bind or hang up in the body bore.

b. Assemble parts (17) through (15) together. Insert the assembled parts (seat first) into compensator body (11). Assemble with spool bores in vertical position to prevent seat from falling into cross port. Visually observe proper assembly through load sensing port. The seat must rest against compensator spool (18) at completion of assembly.

c. Thread new adjusting screw (14) into body (11) bore until top of adjusting screw is .065 below body (11) surface.

d. Install "O" ring (13) over plug (12) and thread plug (12) into compensator body (11).

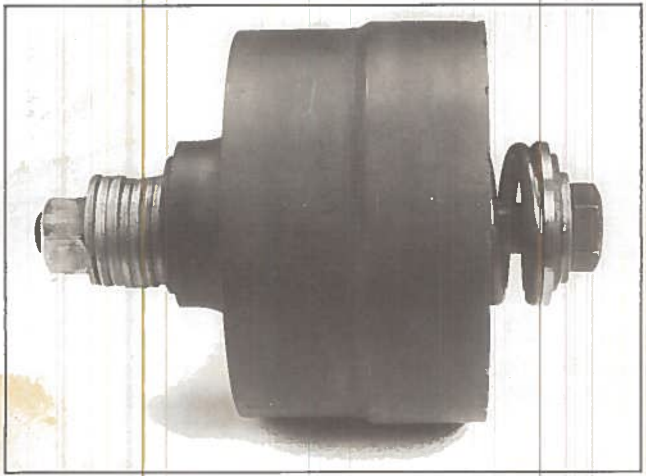


Figure 14. Cylinder Block Subassembly Disassembly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

2. Install plug (24) into the "C" and "CV" compensator bodies. Plugs were installed into the "CVP" compensator body during the preceding step.

3. Install parts (10) through (3) into compensator body (11). Make sure the spool (10) does not bind within the bore. Refer to procedure established in step B.5 for further information. Lockwire and seal (4) will be installed during test procedure Section VII.

4. Install gasket (2) in place on the face of compensator body (11). Cover the compensator body with clean Kraft paper and set aside for final assembly of the pump.

NOTE
Readjustment of the pressure limiter and load sensing compensators is required.

D. REMOVAL AND DISASSEMBLY OF ROTATING GROUP

1. Remove the six screws (25) which hold pump housing (27) to valve block (26).

2. Pull valve block (26) away from housing (27) then discard gasket (30).

3. Remove wafer plate (28) and pins (29) from the valve block and set aside for inspection.

4. Remove bearing (32) and bearing spacer (33 on PVE19/21 models) from the end of drive shaft (48).

5. Slide the rotating group from the pump housing. (Hold the shoe plate with both hands during removal to prevent the group from separating.)

NOTE
The rotating group consists of a cylinder block S/A (34), nine piston and shoe subassemblies (43), the shoe plate (42), a spherical washer (41), three pins (39) and a pin retainer (40).

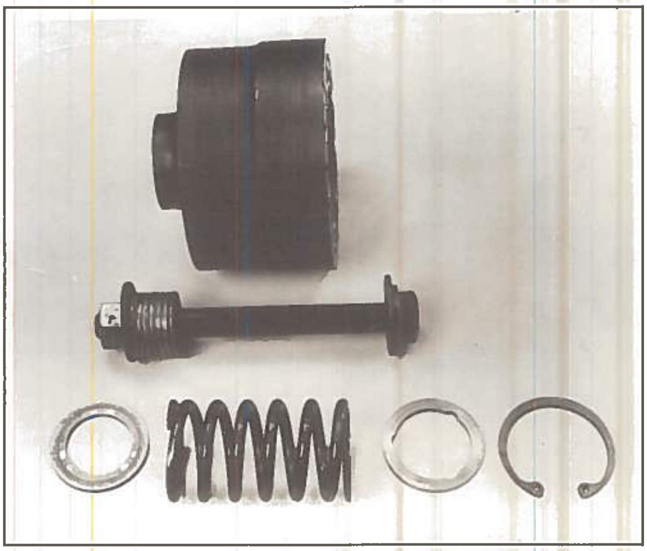


Figure 14a. Cylinder block subassembly parts.

CAUTION
The spring located within the cylinder block S/A is under a high tension and can cause bodily harm if the retaining ring is removed. See Figure 14 for disassembly instructions.

6. Separate the rotating group components and set aside for inspection. Use care when handling these close tolerance parts to prevent burrs from forming.

E. INSPECTION REPAIR AND REPLACEMENT

1. Check bearing (32) for scoring or brinelling of the rollers (PVE19/21).

2. Check bearing spacer (33) for burrs (PVE19/21).

3. Inspect cylinder block S/A face (34) for wear, scratches and/or erosion between cylinders. Check the spring, washers and retaining ring located within the cylinder block S/A.

4. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (43) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston, lubricate with clean hydraulic fluid and try again. Even minor contamination of the fluid could cause the piston to freeze up in the cylinder bore.

5. Inspect each piston and shoe subassembly (43) for a maximum end play of 0.005 inch between the piston and shoe.

6. The face thickness dimension of each shoe must be within 0.001 inch of each other.

7. Inspect shoe plate (42) for excessive wear and cracking in the area of spherical washer (41). If heavy wear or cracks are found, replace the shoe plate and spherical washer at the same time.

8. Check spherical washer (41) for burrs, wear and possible scratches due to pin breakage. Replace if wear is excessive.

9. Inspect pins (39) for equal length, excessive wear and possible bending. Replace all pins simultaneously if one is defective.

10. The pin retainer (40) may develop burrs. Remove all burrs with an India stone.

11. Inspect the face of wafer plate (28) for excessive wear, scratches and possible fracture. If the wafer plate is fractured, make sure the new plate rests flat against the valve block at assembly and that wafer plate pin (29) does not extend too far and hold the wafer plate away from the valve block.

NOTE
Inspect the yoke face and shaft bearing as follows: If either are defective, perform step E.14 and remove the yoke from the housing. If the drive shaft is defective, follow procedure shown in step E.17 to remove the drive shaft from the front bearing. If the drive shaft, shaft bearing, housing or valve block are replaced, a shaft bearing preload adjustment must be performed. See Section VI.J.

12. Inspect pump drive shaft (48) for wear, chipped splines and burrs. Remove burrs with an India stone.

13. Inspect shaft bearing (61) for brinelling, pitting of the rollers and roughness when turned in race (62) located in the housing. If the bearing is defective, both the bearing and the race must be replaced. If the bearing shows no evidence of wear, DO NOT remove the bearing race from the housing or the bearing from the shaft. If the bearing requires removal, perform the following steps 14 through 18.

14. Inspect yoke (56) face for wear, roughness or scoring.

a. Remove the four screws (49) that hold pintle covers (50) on each side of the housing. Remove the pintle covers. Be careful not to damage the shims which lie directly under the covers.

b. Retain shims (51), if possible, and use a micrometer to measure the total shim thickness. If the bearings are not defective, the same shims or a new shim of the same thickness will be needed to preload the bearings at installation. Remove "O" rings (52) and bearing spacers (53) from each pintle.

NOTE
If shims (51) were destroyed during disassembly, a yoke bearing preload adjustment must be made at assembly.

c. Slide the yoke from side to side to loosen the yoke bearing races (54) within the housing. The races are a normal slip fit but may be tight. Use an open end wrench between the yoke and the pintle bearing to help slide out the races. Apply pressure to bearing (55) at the approximate center and allow the bearing rollers to gently press the race out of the housing.

15. Remove yoke (56) and drive shaft (48) from the housing together. Turn the yoke at an angle and slide the two parts out of the housing. See Figure 15.

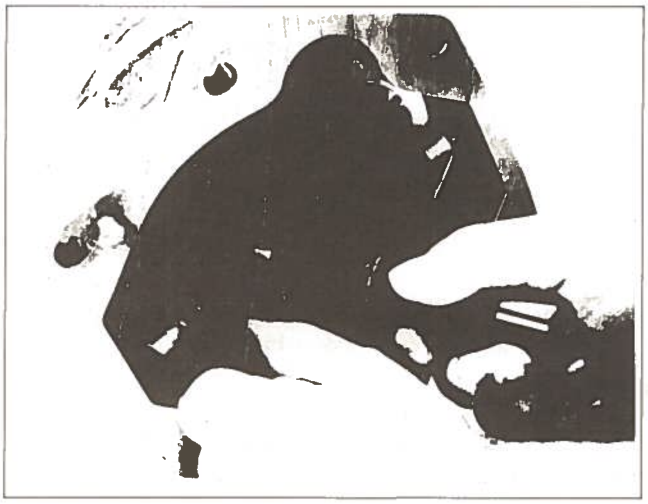


Figure 15. Removal of Yoke and Shaft From Housing.

16. After removal of yoke from the housing, remove seat (59) and yoke spring (60). Seat (58) and rollpin (57) will be attached to yoke (56). DO NOT disassemble further unless seat (58) is damaged.

NOTE
Normally a wear pattern will exist on seat (58). If the seat is damaged or shows heavy wear, replace seat (58) and (59) and rollpin (57).

NOTE

If drive shaft (48) is defective, perform step E.17. If front bearing (61) was defective, perform steps E.17 and 18.

17. Remove bearing (61) from shaft (48) with the nine inch piece of 1½" heavy wall tubing shown in Figure 9. Press off with an arbor press.

18. Remove bearing race (62) from housing (27) as shown in Figure 16. Use special tool shown in Figure 10.

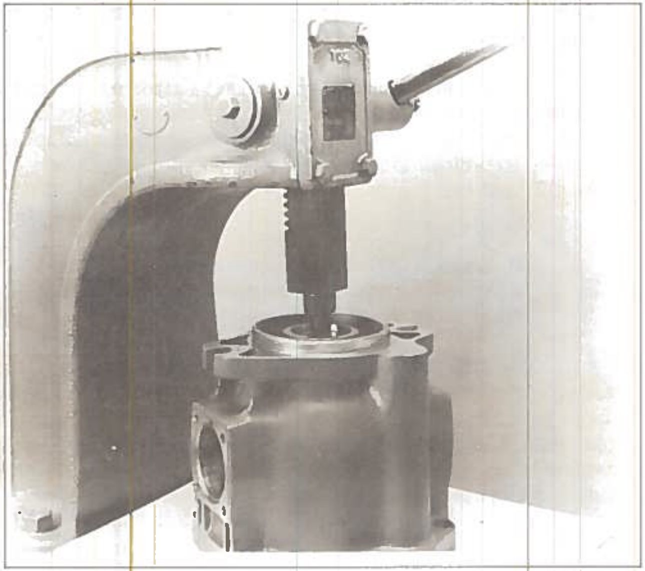


Figure 16. Removal of Front Bearing Race.

NOTE

For units without shaft seal, omit shaft seal removal and installation procedure.

19. Remove retaining ring (44) then press shaft seal (45) from pump housing (27).

NOTE

If yoke (56) and front shaft bearing (61) were not defective, perform the following step.

20. Remove and replace shaft seal (42) located within housing (27) as follows: (Refer to Figure 17.)

NOTE

For units without shaft seal, this step will be used to remove a defective drive shaft only. In addition, references to shaft seal installation and removal must be omitted.

a. Install a nine inch piece of 1½" heavy wall tubing over drive shaft (48) within the housing. The end of the tubing will rest against the inner race of tapered roller bearing (61) and extend out beyond the end of the pump housing. Place the complete unit with tubing into an arbor press with drive spline up. Press the drive shaft through the bearing and out of the unit. A 0.001 press exists between the shaft and bearing so considerable force is required to remove the bearing. See Figure 17 (PVE19/21).

b. Remove retaining ring (44) and pull shaft seal (45) from housing (27). Be careful not to damage the aluminum die cast housing in the seal area.

c. Press drive shaft (48) into shaft bearing (61) as follows: Use a short piece of 1½" inch heavy wall tubing (approximately 6" long) over the drive spline of the shaft. The tubing must be long enough to go through the shaft seal end of the pump and make contact with the inner race of the front bearing. Press the shaft through the bearing with an arbor press until the bearing bottoms against the shoulder of the shaft (snap ring on the PVE12). See Figure 18.

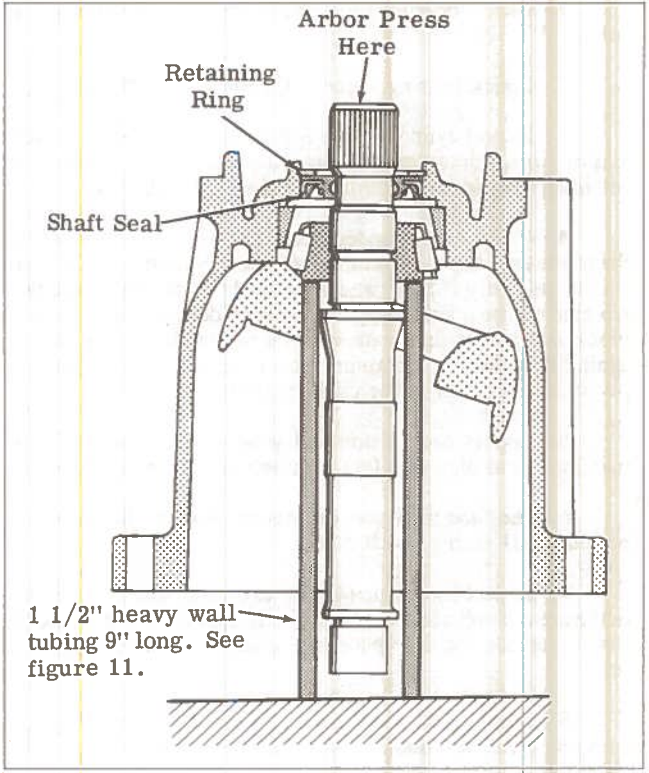


Figure 17. Front Bearing Removal.

d. Remove the short piece of tubing and turn shaft bearing (69) in its race with the end of the shaft. The bearing rollers must turn free and smooth.

e. Tape the spline end of drive shaft (48) with plastic tape to prevent cutting new shaft seal (45). Start taping the shaft close to the housing and work toward the end of the shaft. Install a new shaft seal in position over the shaft and press evenly into the housing. Use shaft seal driver shown in Figure 12. The seal must be positioned just below the retaining ring groove. Install retaining ring (44, 47 for PVE12) into the housing. Use internal Truarc pliers to install retaining ring.

F. ASSEMBLY OF HOUSING PARTS

NOTE

If a new shaft bearing (61), shaft (48), valve block (26) or housing (27) is required, a complete preload adjustment must be performed. If the same parts are returned to service, the shaft bearing preload adjustment can be omitted. The same procedure applies to yoke (56) and its associated bearings.

1. If the shaft bearing (61) requires replacement, install a new bearing race (62) into housing (27). Use tool shown in Figure

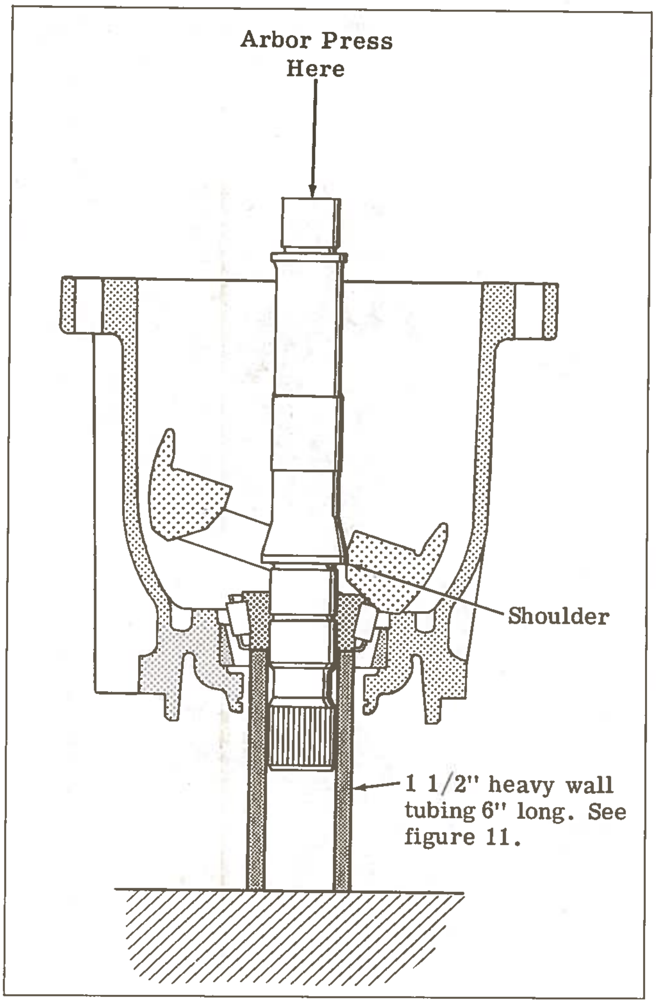


Figure 18. Front Bearing Installation.

11 to press bearing race in place. Make sure bearing race (62) is oriented properly to accept the roller bearing before pressing into the housing. The race must be bottomed against the shoulder of the housing at completion of press.

2. Place housing (27) on a flat surface with the shaft seal end down. Lay front shaft bearing (61) into the race. Install yoke spring (60) and seat (59) into the housing.

3. Position the yoke pintles properly and install yoke into housing. Assemble yoke bearings, races and spacers as follows:

a. Assemble pintle bearings (55) on each end of the yoke and insert bearing races (54).

b. Install bearing spacer (53) at one pintle end.

c. Install "O" ring (52) against spacer (53) into the groove, then install a 0.010 inch shim (51) under pintle (50). Install four pintle cover screws (49) and torque to 175-185 lbf. in.

NOTE
Early designs used a screw and washer arrangement. These should be torqued to 115-125 lbf. ft.

d. Set housing (27) on its side so the other pintle is up. Install bearing spacer (53) and rotate the yoke back and forth to seat bearings (55) within the bearing races. With spacer (53) fully in against the bearing race, measure the height of the spacer with respect to the housing pintle face in two places (180° apart). Use a depth micrometer to perform this measurement. See Figure 19. Average the readings to obtain a nominal value. A 0.007-0.009 inch preload is required on the pintle bearings. Calculate the necessary shims to provide this preload as follows: Assume the depth readings were 0.029 and 0.027 inch. Add the two figures together and divide by 2 to obtain the average. In this case the calculated average is 0.028 inch. Subtract the nominal preload of 0.008 inch from the calculated average to obtain the required shim thickness.

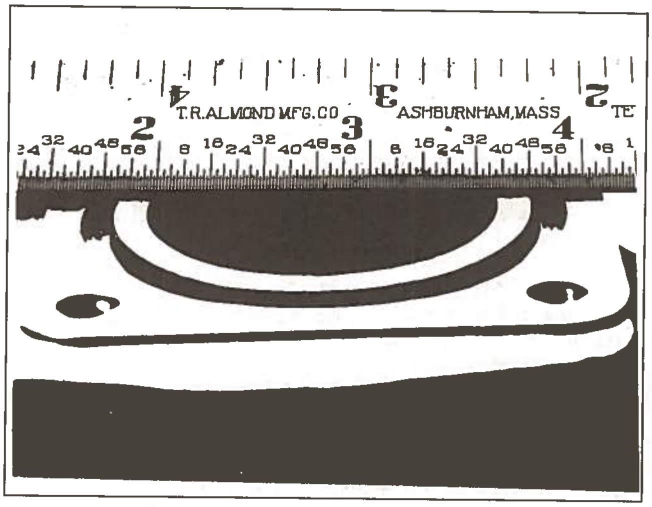


Figure 19. Pintle bearing spacer height with respect to pintle face.

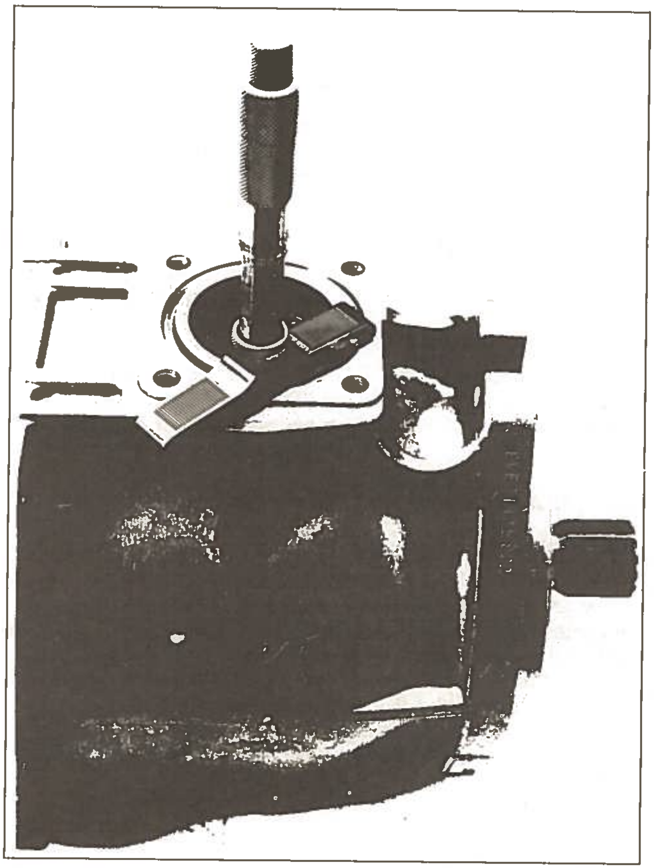


Figure 19a. Measuring height of pintle bearing spacer with respect to the pintle face.

NOTE

If the calculated shim thickness is greater than 0.020, another shim must be added to the opposite side of the yoke to reduce the total shim thickness to less than 0.020. Shim thickness at either pintle must not exceed 0.020. This is necessary to provide proper "O" ring compression and prevent pintle seal leakage.

e. Install the correct shims (51) and cross torque pintle cover (50) screws to 175-185 lbf. in.

NOTE

The yoke (56) will be stiff but should be loose enough to be moved by hand (approximately 20 lbf. in torque). The tightness/drag indicates the bearings are preloaded. If the yoke cannot be moved by hand, the preload is too great. Repeat the preload adjustment until correct.

4. Assemble the rotating group and install into housing as follows:

a. Assemble the spring, two washers and retaining ring into the cylinder block. The washer with three notches is assembled next to retaining ring. See Figure 14 for instructions. Set the cylinder block S/A (34) face on a flat clean surface. Use Kraft paper between the block and surface to prevent scratching the cylinder block face.

b. Install pin retainer (40) into cylinder block. Position the pin retainer approximately ¼ " below the surface, and orient the open end of the pin retainer to be away from the large spline openings.

c. Slide the three pins (39) into cylinder block S/A (34) until they bottom against the spring washer within the block.

d. Place spherical washer (41) on top of the three pins, then install shoe plate (42) with nine piston and shoe subassemblies (43) over spherical washer (41) and into cylinder block. Wobble shoe plate (42) to make sure that each piston is free within its bore in the cylinder block.

e. Set housing (27) on its side and hold pump shaft (48) horizontal. Slide rotating group into the housing. Rotate the shaft to match the shaft splines to the cylinder block and spherical washer.

5. If alignment pins (31) were removed, install two alignment rollpins (31) into housing (27). Place gasket (30) over the rollpins, cover with Kraft paper and set aside for final assembly.

G. DISASSEMBLY OF VALVE BLOCK

1. DO NOT disassemble check valve parts (64) through (66), unless action of the valve indicates a problem. Check the valve action with a pencil or a screwdriver. Press the check valve in against the spring, it should return and hold firm against the seat. If the check valve is defective, remove and replace the complete assembly. Press new seat (64) flush with face of valve block. DO NOT scratch the face of valve block (26).

2. Remove parts (67) through (73) from valve block (26).

NOTE

If bearing (32) was defective, perform the following step.

3. For PVE19/21, remove bearing race (63) from valve block (36). The PVE12 roller bearing is in the valve block. Refer to Figure 20 for removal information and use tool shown in Figure 10 for PVE**G units. Use tool shown in Figure 10a and procedure shown in Figure 20a for PVE** units with a blind hole in valve block (26). BE CAREFUL not to scratch face of the valve block during removal of the race.

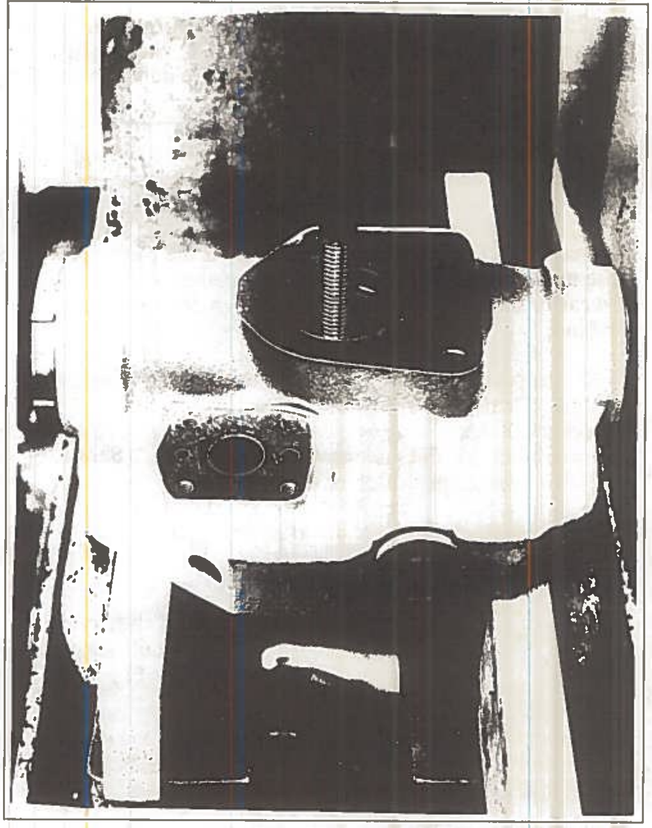


Figure 20. Removal of bearing race from valve block.

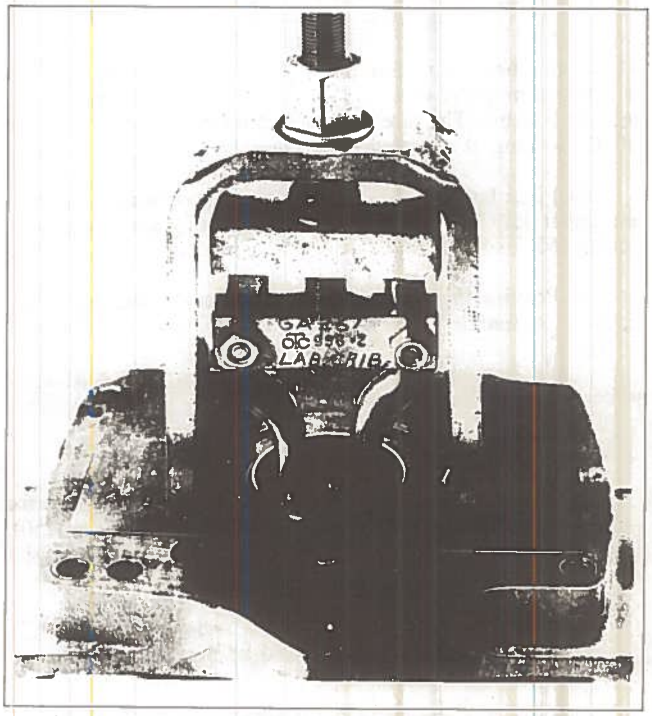


Figure 20a. Removal of bearing race from valve block with blind hole.

H. INSPECTION, REPAIR AND REPLACEMENT

1. Clean all parts and place them on a clean sheet of Kraft paper for inspection. Follow general procedure noted in paragraph VI. GENERAL.

2. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs. If threads are defective, replace the plug.

3. Inspect compensator piston rod (73) for nicks and burrs. Remove burrs and sharp edges with an India stone.

4. Inspect compensator piston (72) for wear at the area of yoke contact. The compensator piston and the piston rod are a close tolerance fit and must assemble together without evidence of wear or bind. Rotate the piston through 360° when checking for bind.

5. Inspect valve block (26) for burrs, nicks, plugged body passages, flatness of the pump wafer plate area and porosity. Inspect check valve seat (64). Make sure the seat is tight within the valve block and does not protrude above the valve block face. Repair or replace the valve block if defective.

I. ASSEMBLY OF VALVE BLOCK

NOTE
Refer to Figure 13 during the following assembly procedures.

1. If bearing (32) was defective and bearing race (63 for the PVE19/21) has been removed, a new bearing race must be installed into the valve block. Refer to Figure 21 and press a new bearing race in place with an arbor press. The bearing race must bottom against the shoulder of valve block at completion of press.

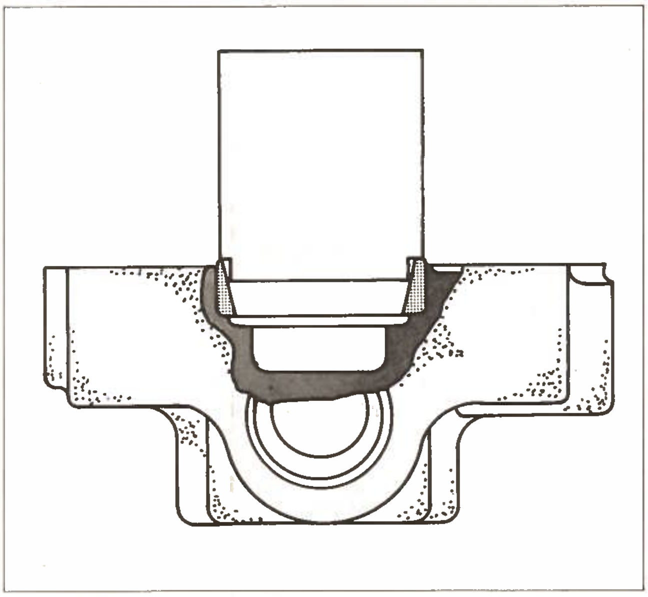


Figure 21. Installation of bearing race into valve block.

NOTE
Check flatness of the valve block face in the area around each locating pin hole (31) and at bolt openings (25). Use an India stone to remove burrs or raised metal in these areas.

2. Install pipe plug (69) into valve block (26) and secure.

3. Assemble a new "O" ring (68) on hex plug (67) and thread plug into place.

J. SHAFT BEARING PRELOAD ADJUSTMENT (PVE19/21 only)

NOTE
If the shaft bearings, shaft, valve block or housing were not replaced, use the bearing spacer removed during the disassembly procedure to preload the shaft and perform step J.7. If preload adjustment is necessary, perform steps J.1 through J.7.

1. Install the thickest bearing spacer (33) over shaft (48) with the chamfer facing into the housing (toward the shoulder on the shaft).

2. Slide new bearing (32) on the shaft and up against spacer (33). The small diameter of the tapered roller bearing must face out of the housing.

3. Install housing (27) to valve block (26) without gasket (30) and rotating group. Turn shaft (48) to seat the bearings then torque the six housing attaching screws (25) to 5 lbf. in. Check the opening between the valve block and housing to be as even as possible after tightening.

4. Use a feeler gauge to measure the opening between valve block (26) and housing (27). Four measurements should be obtained equidistant around the unit. A tapered feeler gauge is especially useful for this purpose. Average the four readings by adding them together and dividing by 4. Calculate thickness of the shaft bearing spacer as follows:

+0.150	Measured thickness of bearing spacer
−0.027	Average gap (estimated)
+0.003 ± 0.001	Preload setting
+0.020	Compressed thickness of gasket
0.146 ± 0.001	Required bearing spacer thickness to provide a 0.003 ± .001 bearing preload.

5. Remove six mounting screws (25) then remove housing (27) from the valve block.

6. Remove bearing (32) and bearing spacer (33).

7. Locate a bearing spacer with calculated dimensions and place next to the new bearing on the shaft. Chamfer must face shoulder on shaft. Use the original spacer and bearing if preload is not performed. Set aside for final assembly.

K. FINAL ASSEMBLY OF THE PVE SERIES PUMP

NOTE
Lubricate all moving parts of the piston pump with clean system fluid to facilitate assembly and provide initial lubrication. Pour system fluid liberally over the rotating group and wafer plate as these parts are without lubrication until the pump primes.

1. Assemble wafer plate locating pin(s) (29) into valve block (26). Refer to Figure 13.

2. Assemble wafer plate (28) over the bearing race (pins on the PVE12) and locating pin (29) with wear surface away from valve block (26). Determine from the model code which wafer plate is used. See Figure 22.

CAUTION

The wafer plate must be flat against the valve block face. Check to make sure it does not rock back and forth. If rocking of the wafer plate occurs, check locating pin(s) (29), it may not be bottomed out in the valve block. Rocking of the wafer plate will induce high stress conditions across the wafer plate and cause fractures to appear.

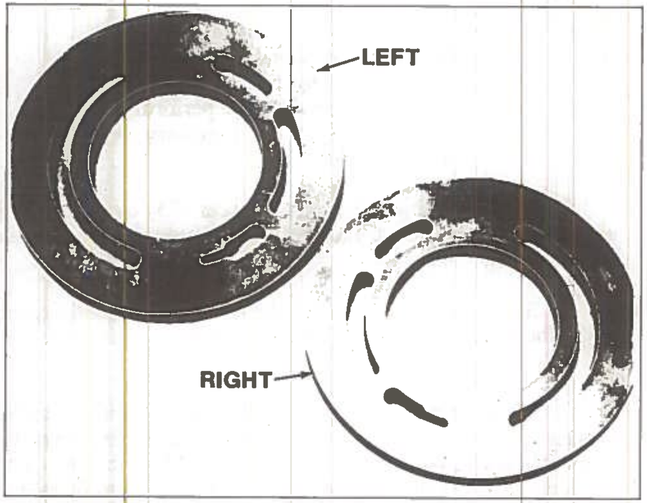


Figure 22. Wafer plates showing right and left hand.

3. Place valve block (26) on its side. See Figure 13 for position required.

4. Install compensator piston rod (73) into valve block (26) and attach spirolox retaining ring (71).

5. Install a new "O" ring (70) in the compensator piston rod "O" ring groove.

6. Install compensator piston (72) over compensator piston rod (73).

7. Assemble housing (27) and valve block (26) together as shown in Figure 13. Thread six screws (25) handtight through the housing into the valve block. Cross torque the screws to bring the valve block and housing together against gasket (30). Final torque screws (25) to 31-35 N.m (23-26 lbf. ft.) for the PVE19/21 and 22-27 N.m. for the PVE12.

8. Check the shaft torque to verify correct bearing preload. If the torque exceeds eight (8) N.m (6 lbf. ft.), perform a shaft bearing preload adjustment, Section VI.J. and repeat steps VI.K.7 and 8.

9. Determine shaft rotation from the arrow stamped on the mounting flange. Refer to Figure 7 and mount the compensator subassembly. Thread four screws (1) through the compensator into valve block (26). Cross torque screws to 7-8 N.m (60-70 lbf. in.).

Section VII – TEST PROCEDURE

A. TEST CONDITIONS

1. Fluid Medium: SAE 10W meeting API service classification MS or equivalent.

2. Fluid Temperature: 120° ± 5° F. at pump outlet.

3. Fluid entering the pump must be maintained below a maximum contamination limit of class four according to NAS1638.

B. PRELIMINARY CHECK

1. Rotate the drive shaft through one complete revolution. The shaft must rotate with less than 8 N.m (6 lbf. ft.) torque and be free without evidence of binding.

2. Direction of rotation by the model code stamped into the edge of the mounting flange. See Table 1 for definition of model code variables.

C. PRELIMINARY SET-UP

NOTE

Install unit as shown in test circuit diagram with case drain up. Use the correct circuit diagram for the unit: Figure 23 - PVE19/21 (G)-*-**-C/CG-1*. Figure 24 - PVE19/21 (G)-*-**-CV/CVP/CVPC units.

1. Maintain 0-10 Psig at pump inlet.

2. Fill pump housing with system fluid and connect case drain line.

3. During test, case pressure must not exceed 15 Psig.

4. Pressure differential between case and inlet must be 0-5 psid unless otherwise indicated. (Note: A special test for maximum differential pressure between case and inlet will be performed later.)

D. PERFORMANCE TEST

1. Open globe valves V1 and V2.

2. Set load valve one (1) to minimum pressure. If the unit has an auxiliary gear pump, set load valve two (2) to minimum pressure.

3. Turn compensator plug (9), Figure 13, clockwise until seated.

4. Jog the unit under test until prime occurs. If the unit has an auxiliary gear pump, both pumps must prime before proceeding.

5. Operate the unit at 1200 RPM and 100 Psig until all air is expelled from the test circuit.

6. Piston pump case leakage must exceed 10cc/minute as read on flow rater Q2.

E. PERFORMANCE TEST OF PISTON PUMP WITH 'C' COMPENSATOR CONTROL

1. Adjust load valve one (#1) and globe valve one (V1), Figure 23, to exactly 100 Psig as shown on gauge P1. The unit must meet the following requirements at full stroke, and 1200 rpm. See Table 4. Record the flows obtained.

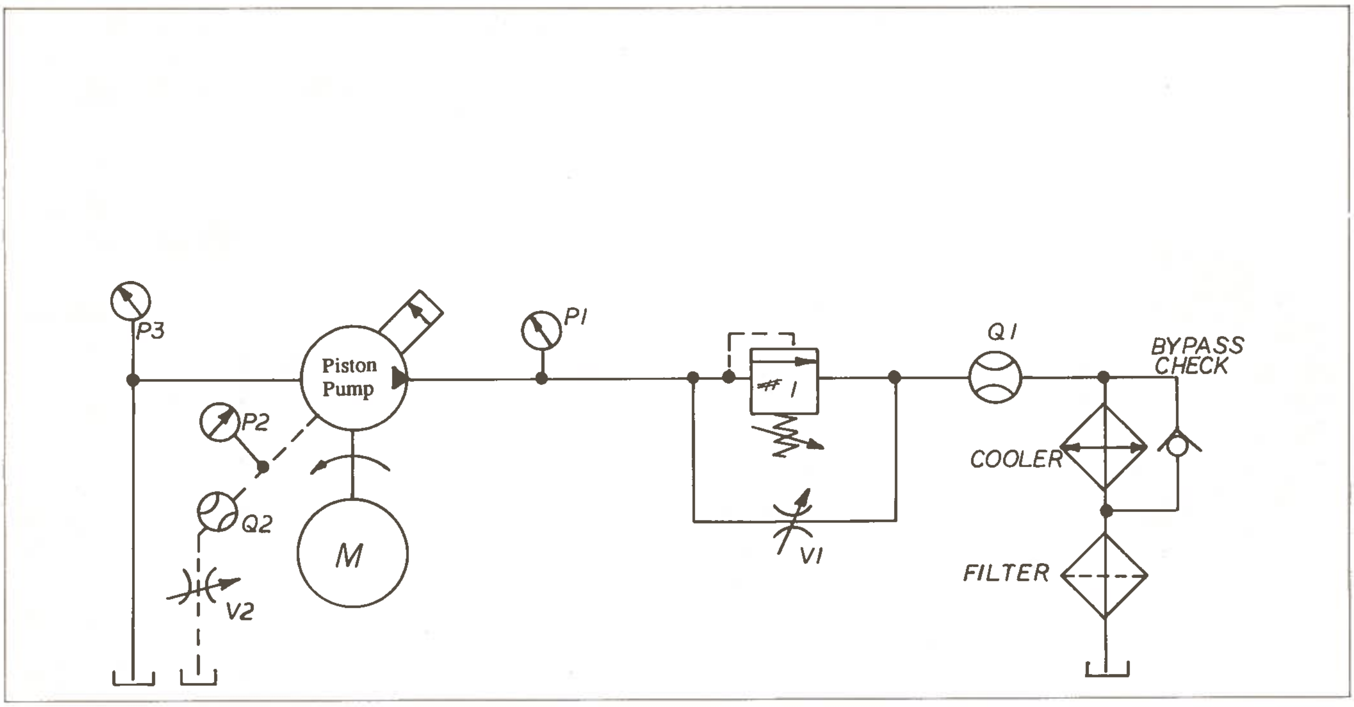


Figure 23. Circuit Diagram for ''C'' & ''CG'' Control

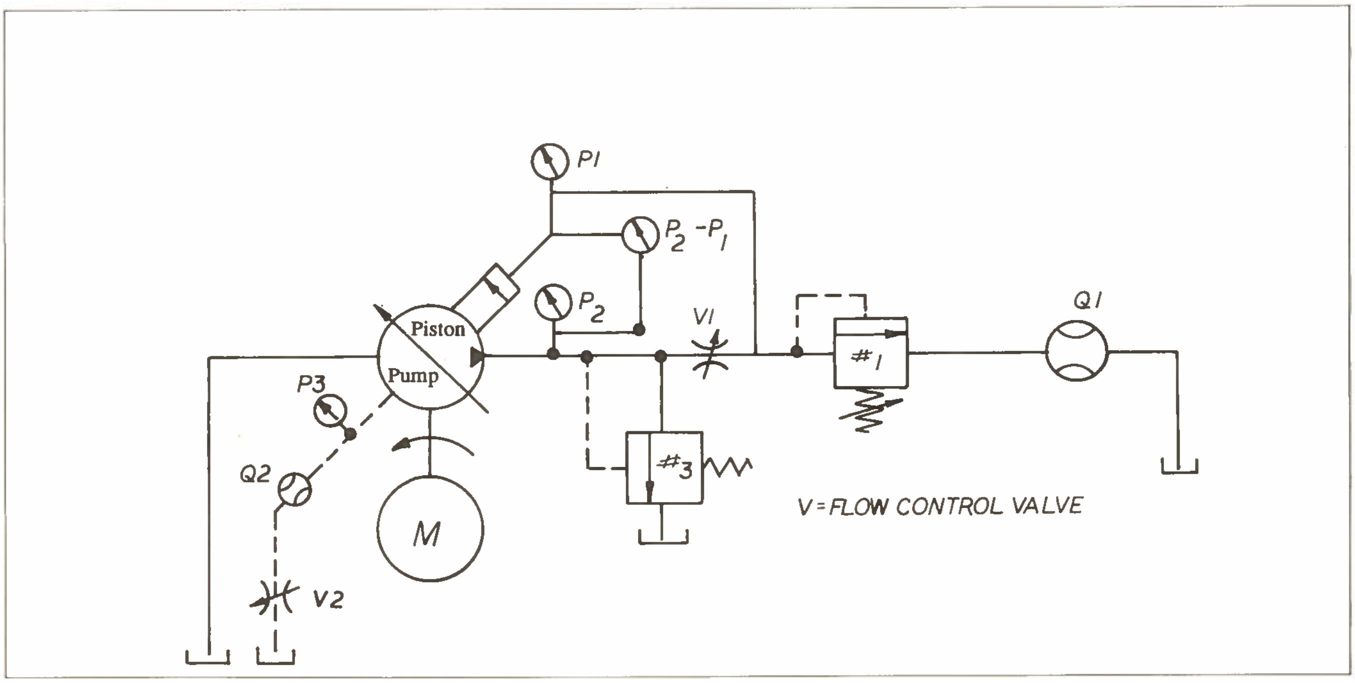


Figure 24. Circuit Diagram for "CV", "CVP", "CVPC" & "CVPD"

2. Close globe valve one (V1) and re–adjust load valve one (#1) to system pressure shown in Table 5. Read Psig at at gauge P1.

3. Check delivery loss and case leakage as follows. (See Table 5.)

4. Open globe valve one (V1) and load valve (#1).

5. Back off compensator adjustment screw until approximately 0.060 inches of threads are exposed. Close load valve one (#1) and globe valve one (V1). The pressure as read at gauge P1 must not exceed 250 Psig.

6. Adjust the compensator screw to retract the yoke to minimum stroke position at Table 6 pressures. Case drain leakage not to exceed 2 USgpm. Pressure fluctuations must not exceed 50 Psig. Rapid globe valve (V1) movement from open to closed must not produce yoke hunting.

7. With the pump operating at cutoff, close the case drain ports slowly (globe valve V2) while observing gauge P2. Pressure differential P2–P3 must be 6–12 Psid with globe valve V2 fully closed. If pressure starts to exceed 12 Psid while closing globe valve V2, the internal check valve is malfunctioning. DO NOT close globe valve V2 further. Return to the open condition and repair the malfunction.

100 psi SYSTEM PRESSURE			
	PVE12	PVE19	PVE21
Delivery	7.5–8.4 USgpm	12.5–13.5 USgpm	13.75–14.85 USgpm
Max. Case Leakage	620cc/min.	800cc/min.	800cc/min.

Table 4. Maximum flow and maximum case leakage at 100 psig

	3000 psig SYSTEM PRESSURE		2700 psig SYSTEM PRESSURE
	PVPE12	PVPE19	PVPE21
Max. Delivery	1.15 USgpm	1.50 USgpm	1.50 USgpm
Loss Max. Case Leakage	1.12 USgpm	1.45 USgpm	1.45 USgpm

Table 5. Delivery loss and maximum allowable leakage at indicated psig.

8. With load valve one (#1) set to pressure noted in Table 6 and globe valve V1 fully closed, the pressure at P1 must return within 50 Psig of initial setting.

9. Drill and lockwire the compensator adjusting screw (9) Figure 13.

10. Check for signs of external leakage (none permissible) including seal shaft.

11. Remove power, remove unit from stand, drain case, then plug openings to prevent dirt from entering the unit. This completes test and adjustment of the piston pump and 'C' compensator S/A.

MODEL NUMBER	LOCKWIRE	PRESSURE SETTING
PVE12/19*–*–**–C–10	YES	3000 psig
PVE21*–*–**–C–10	YES	2700 psig

Table 6. Final compensator pressure setting

F. PERFORMANCE TEST OF PVE12/19/21 PISTON PUMP WITH "CG" COMPENSATOR CONTROL

1. Operate pump at 1200 RPM. Set remote control valve to minimum pressure setting.

2. Refer to Figure 23 and adjust load valve (1) and globe valve (1) to 100 PSI system pressure at P1. Observe maximum pump flow and maximum case leakage requirements noted in Table 4.

3. Close load valve (1) and globe valve (1) to obtain minimum pump pressure setting. Minimum pump pressure should be approximately 250 PSI at P1.

NOTE

The "CG" compensator is preset at the factory at 250-350 PSI. When a hydraulic line is attached between the "CG" compensator and remote control valve, back pressure may exist within the hydraulic line. As a result, the back pressure may keep the minimum pump pressure above 350 PSI.

4. Adjust load valve (#1) and remote valve to get maximum system pressure shown in Table 5. Check pump delivery loss and case leakage requirements from Table 5.

5. Re–adjust remote valve settings.

6. Close globe valve (V1). Increase the remote control valve setting until the pump yoke retreats to minimum stroke position. Observe pressure at P1. Case leakage should not exceed 2 USgpm. Open and close load valve (#1). The pressure at P1 should return to within 50 psi of initial setting.

7. Check the pump for external leakage. No external leakage is permissible.

G. PERFORMANCE TEST OF PVE12/19/21 PISTON PUMP WITH "CV", "CVP", "CVPD" & "CVPD" COMPENSATOR CONTROL

NOTE

Refer to Figure 24 for location of circuit components.

1. Open load valve one (1) and turn compensator adjustment plug clockwise until seated.

2. Operate at 1200 RPM and 100 Psig outlet pressure until all air is removed from the test circuit.

3. The case leakage as read at flow rater Q2 must exceed 10cc/minute. Make sure globe valve V2 is open.

4. Adjust globe valve V1 closed. Then adjust relief valve three (3) to a pressure higher than the compensator setting noted in Table 8.

5. Open globe valve V1 and set load valve one (1) for 100 Psig as read at gauge P2.

6. The unit must meet the following requirements at 1200 RPM and full stroke. See Table 7. Record the flow readings.

100 psi SYSTEM PRESSURE		
MODEL CODE	DELIVERY USgpm	MAX. CASE LEAKAGE
PVE12*–*–**–CV–10	11.5	1020 cc/min
PVE12*–*–**CVP/CVP–11/CVPD	11.5	1020 cc/min
PVE19*–*–**–CV–10	12.5–13.5	800 cc/min
PVE19*–*–**CVP/CVP–12/CVPD	12.45–13.45	1200 cc/min
PVE21*–*–**–CV–10	13.75–14.85	800 cc/min
PVE21*–*–**CVP/CVPC–12/CVPD	13.7–14.8	1200 cc/min

Table 7. Maximum delivery and maximum case leakage

VICKERS

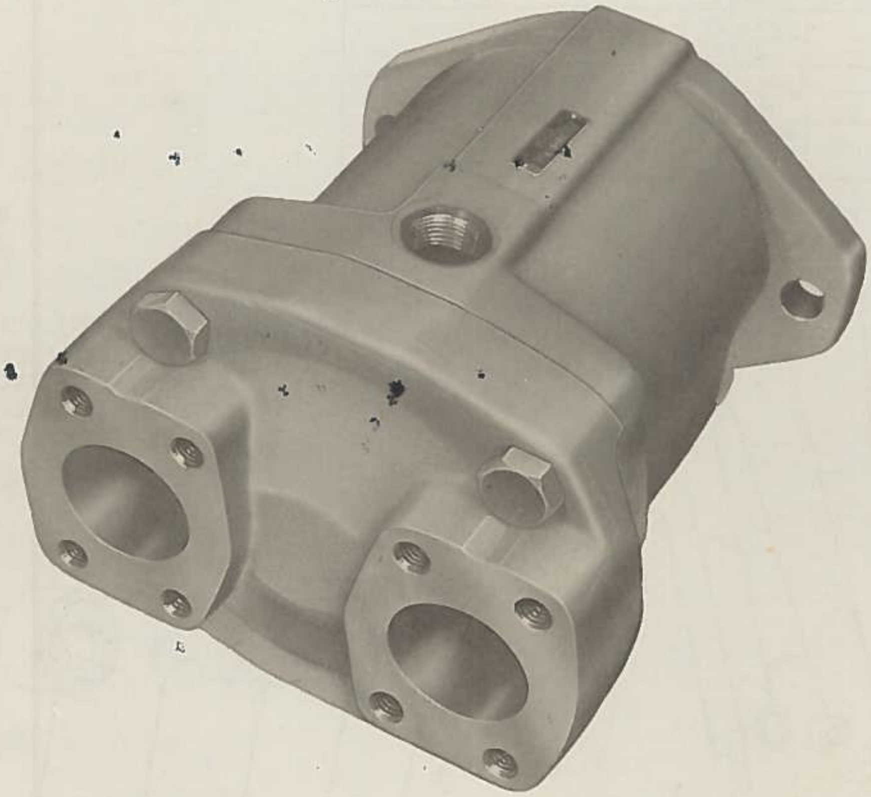
Service Parts Information

45 GPM
Fixed
Inline
Piston
Pump

(M)-PFB45-(F)RF-10/11
(M)-PFB45-(F)LF-10/11
F6-PFB45-(F)*F-10/11

23

23



Vickers, Incorporated

1401 Crooks Road
Troy, Michigan 48084

Revised 9-1-85

I-3250-S

A Libbey-Owens-Ford Company

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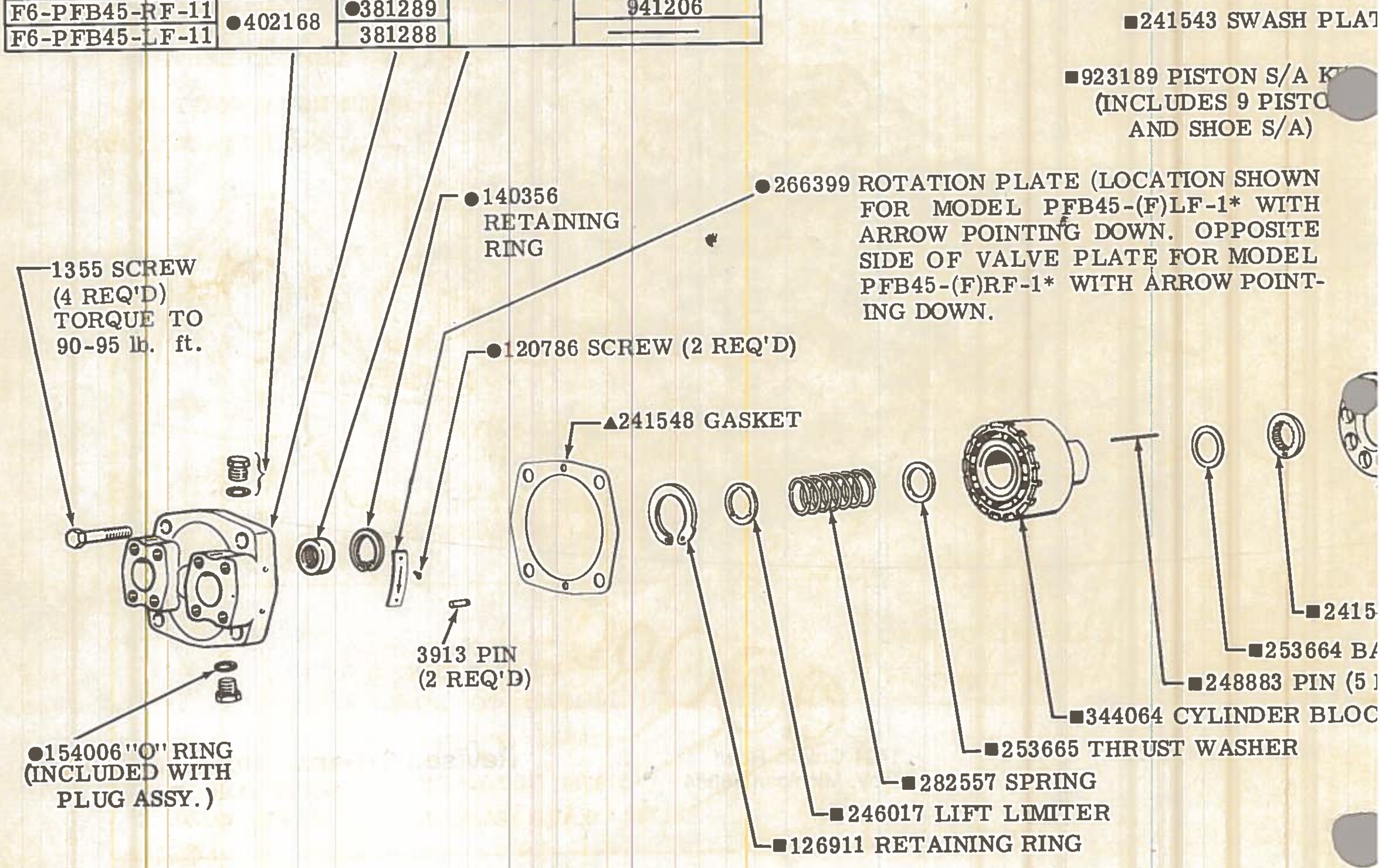
FLANGE CONNECTIONS (NOT FURNISHED WITH UNIT)		
MODEL	PIPE SIZE	TYPE
FL1-16-16P-10	2"	PIPE THREADED
FL1-16-16W-10		PIPE WELDED
FLANGES ARE FURNISHED WITH A SEAL AND SCREWS FOR FASTENING		

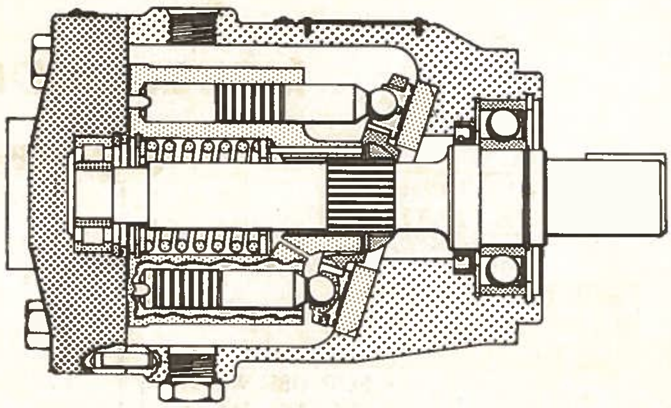
●INCLUDED IN VALVE PLATE KIT

▲INCLUDED IN 919355 SEAL KIT FOR PFB45 MODELS ONLY.

■INCLUDED IN 938286 ROTATING GROUP KIT FOR PFB45 ONLY.

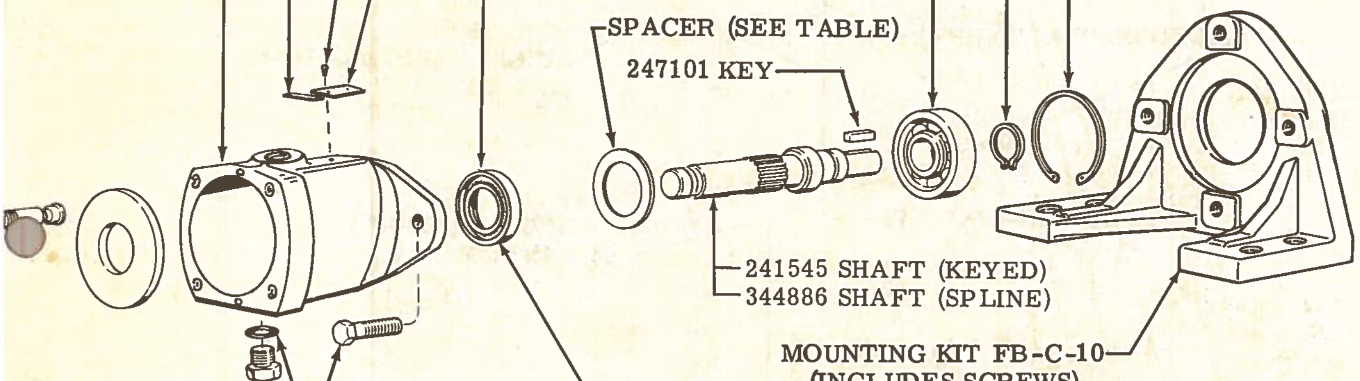
MODEL	PLUG (2 REQ'D)	VALVE PLATE	BEARING	VALVE PLATE S/A KIT
PFB45-RF-10	—	391126	281655	—
PFB45-LF-10		391125		
F6-PFB45-RF-10	—	314790	●388176	
F6-PFB45-LF-10		314787		
F6-PFB45-RF-11	●402168	●381289		941206
F6-PFB45-LF-11		381288		—

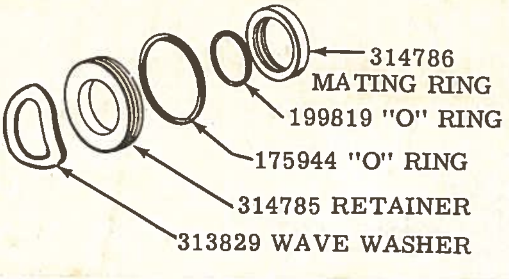




MODEL	HOUSING
PFB45-*F-10	266108
F6-PFB45-*F-10	314782
F6-PFB45-*F-11	374913

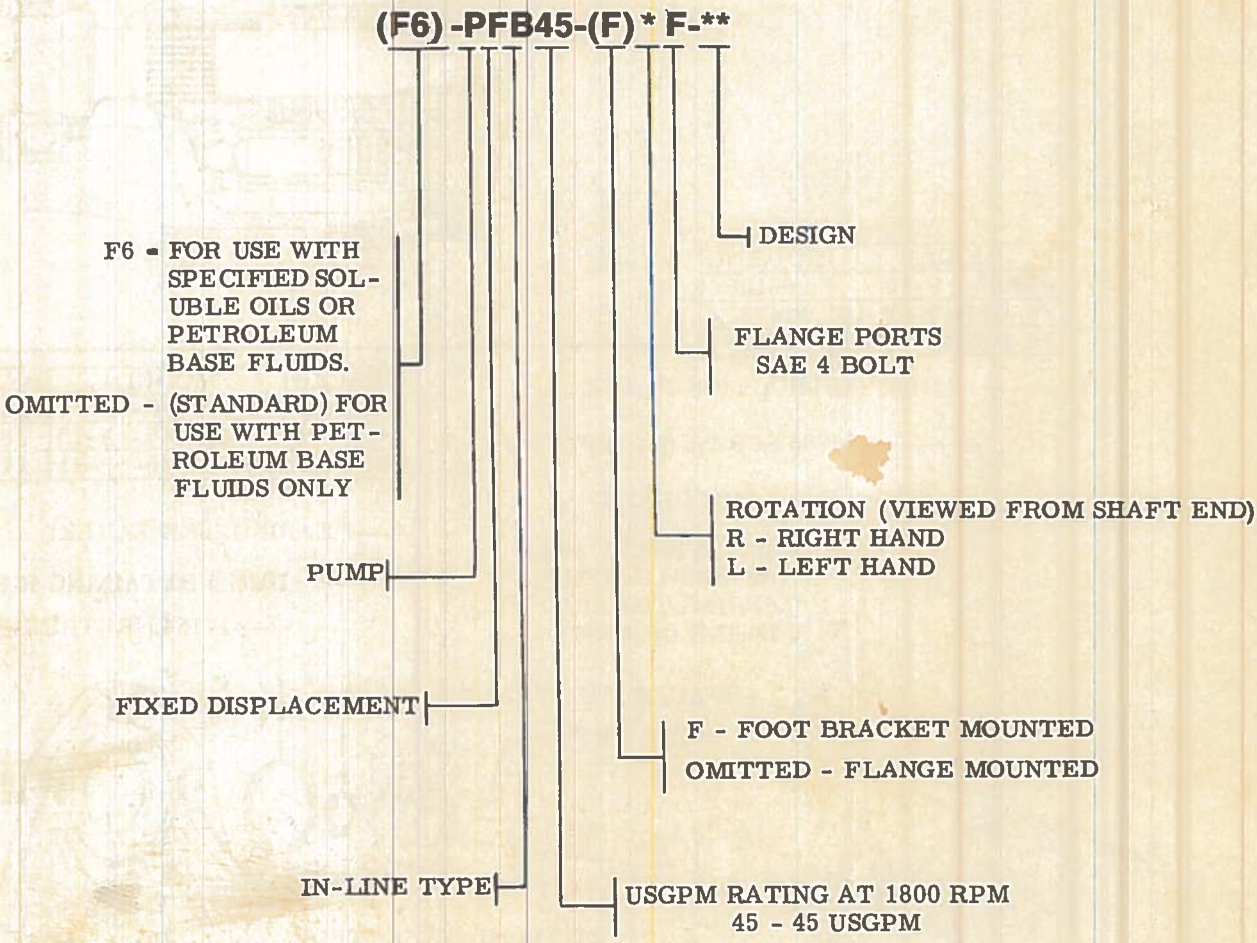
SPACER	MODEL	BEARING
273385	PFB45-*F-10	283662
———	F6-PFB45-*F-10	283662
381298	F6-PFB45-*F-11	119541





SEAL ARRANGEMENT FOR F6 PREFIX MODELS

MODEL CODE BREAKDOWN



(F6) -PFB45-(F) * F-**

F6 - FOR USE WITH SPECIFIED SOLUBLE OILS OR PETROLEUM BASE FLUIDS.

OMITTED - (STANDARD) FOR USE WITH PETROLEUM BASE FLUIDS ONLY

PUMP

FIXED DISPLACEMENT

IN-LINE TYPE

USGPM RATING AT 1800 RPM
45 - 45 USGPM

F - FOOT BRACKET MOUNTED
OMITTED - FLANGE MOUNTED

ROTATION (VIEWED FROM SHAFT END)
R - RIGHT HAND
L - LEFT HAND

FLANGE PORTS
SAE 4 BOLT

DESIGN

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets ISO cleanliness code 16/13 or cleaner. Selections from Vickers OFP, OFR, and OFRS series are recommended.

Litho in U.S.A.

VICKERS®
A TRINOVA COMPANY

Service Parts Information

Thru Shaft, Side Ported Inline Piston Pumps

F3-PVB45A-(F)RSFW-10-CA(G)-11
F3-PVB45A-(F)RSFX-10-CA(G)-11

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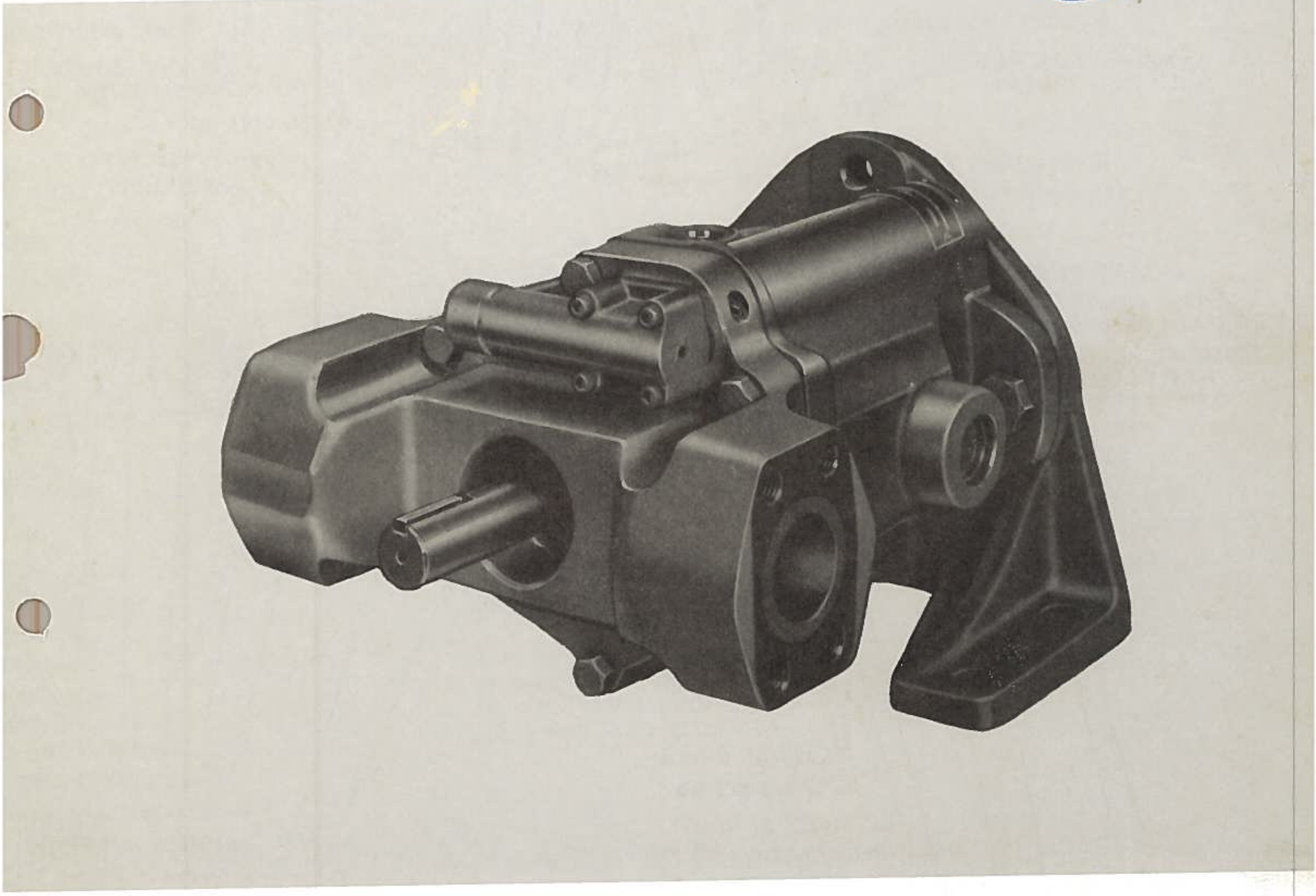

Vickers, Incorporated

P.O. Box 302
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Revised 12-1-87

I-3256-S

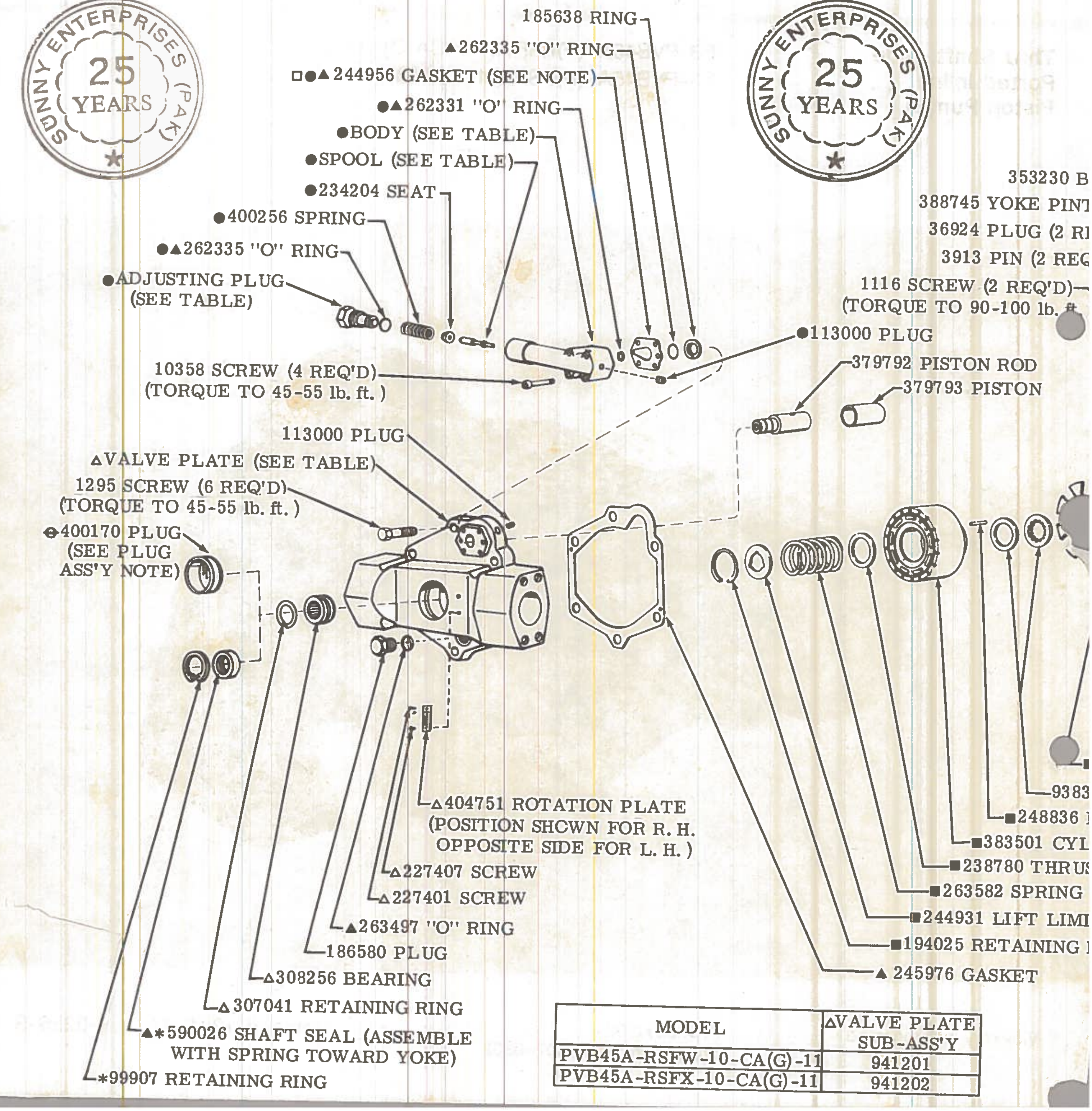
●INCLUDED IN PRESSURE COMPENSATOR S/A				
MODEL	SPOOL	BODY	PLUG	KIT
PVB45A-CA	356986	345858	360430	942287
PVB45A-CAG	296234	412890	412940	942444

□NOTE

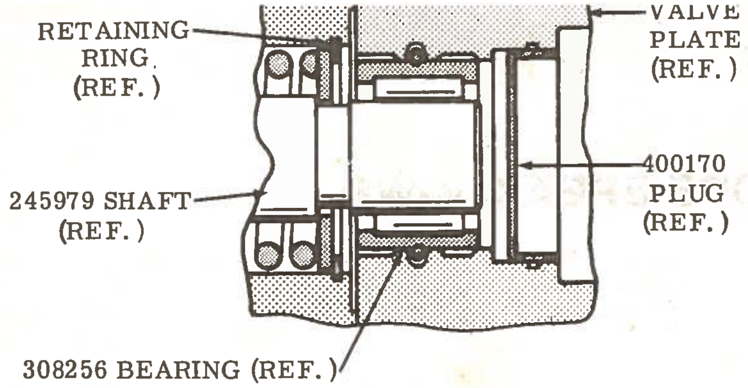
POSITION GASKET WITH SMALL END OF TEARDROP HOLE POINTING IN DIRECTION OF COMPENSATOR ADJ. PLUG.

SUNNY ENTERPRISES (PAK) 25 YEARS

SUNNY ENTERPRISES (PAK) 25 YEARS



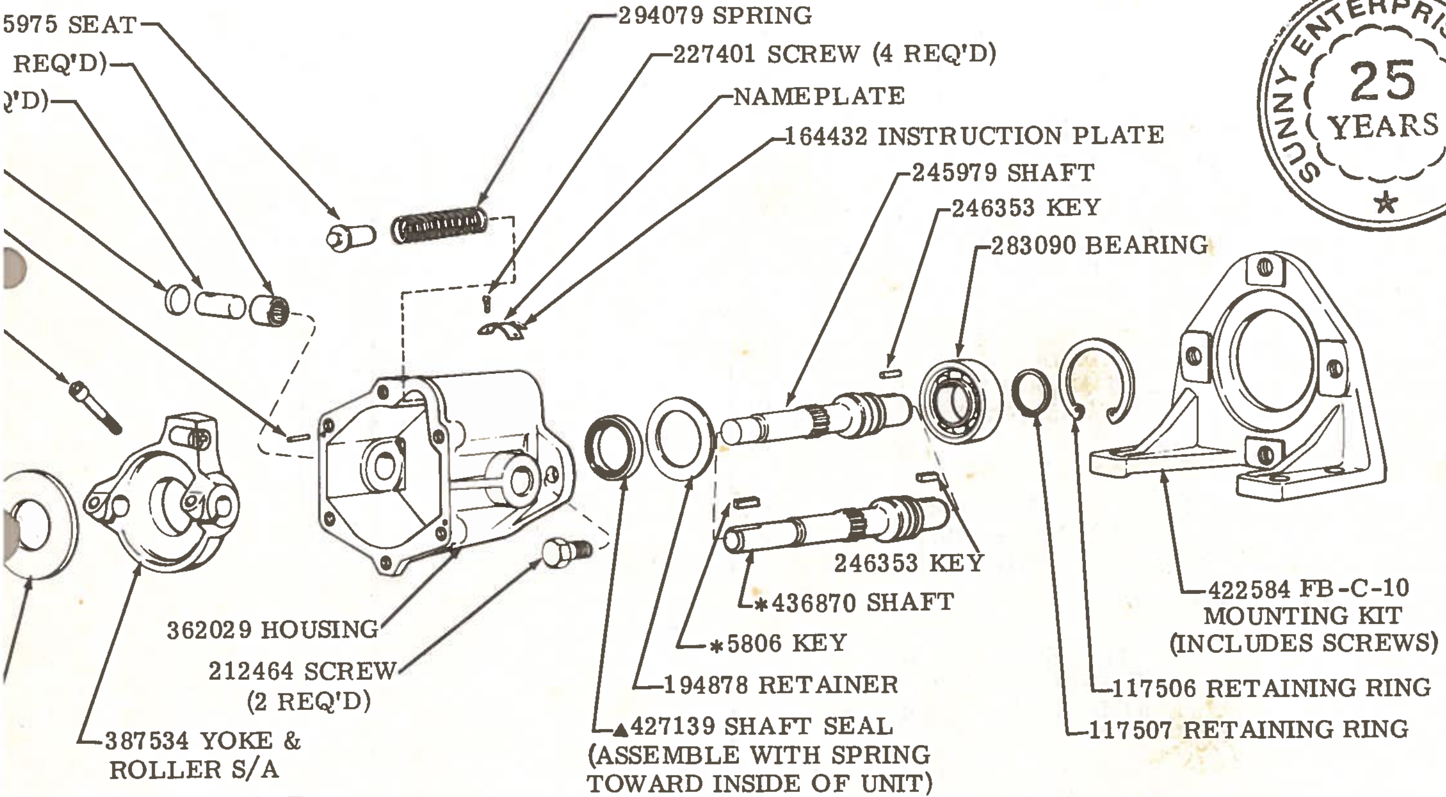
MODEL	△VALVE PLATE SUB-ASS'Y
PVB45A-RSFW-10-CA(G)-11	941201
PVB45A-RSFX-10-CA(G)-11	941202



MAKE CERTAIN 400170 PLUG O. D. AND MATING I. D. IN VALVE PLATE IS CLEAN. APPLY SEALING COMPOUND (LOCTITE GRADE "A" OR EQUIVALENT) TO PLUG O. D. AND PRESS PLUG INTO VALVE PLATE AS SHOWN.

CAUTION
DO NOT ALLOW SEALING COMPOUND TO CONTACT BEARING ROLLERS.

SUNNY ENTERPRISES (PAK)
25 YEARS



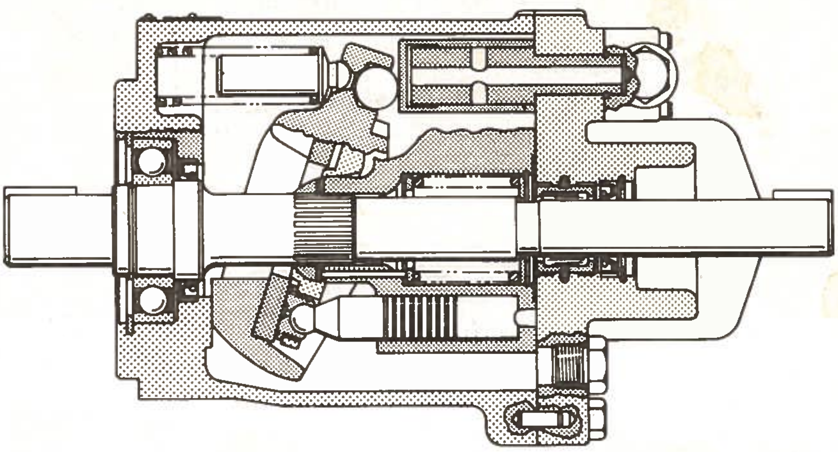
■INCLUDED IN 938074 ROTATING GROUP

⊖ USED ON SIDE PORT 'W' MODELS ONLY

* USED ON THRU-SHAFT 'X' MODELS ONLY

▲INCLUDED IN F3 SEAL KIT 919847 FOR THRU-SHAFT 'X' MODELS.

▲INCLUDED IN F3 SEAL KIT 920305 FOR SIDE PORT 'W' MODELS.



MODEL CODE BREAKDOWN

F3-PVB45A-(F)RSF(*)-10-CA(G)-11

F3 - SPECIAL SEALS FOR MINERAL OIL & FIRE RESISTANT FLUIDS

P - PUMP

V - VARIABLE DISPLACEMENT

B - INLINE PISTON

45 - GPM RATING AT 1800 RPM
45 - 45 GPM

A - MEDIUM PRESSURE DESIGN

(F) - MOUNTING TYPE
F - FOOT BRACKET
(OMIT FOR FLANGE)

R - SHAFT ROTATION
(VIEWING SHAFT END)
R - RIGHT HAND (CW)

S - DISPLACEMENT
S - ONE SIDE OF CENTER

F - PORT CONNECTIONS
F - SAE 4-BOLT FLANGE

(*) -
W - SIDE PORT
X - THRU SHAFT SIDE PORT

10 - PUMP DESIGN
-10/-11

CA - PRESSURE COMPENSATOR
MEDIUM PRESSURE
(200 - 1000 PSI)
CAUTION
MAXIMUM PSI SETTING OF COMPENSATOR MUST BE LIMITED TO THE VALUE INDICATED.

(G) - REMOTE CONTROL OF COMPENSATOR

11 - CONTROL DESIGN NUMBER

For satisfactory service life of these components, use full flow filtration to provide fluid which

6

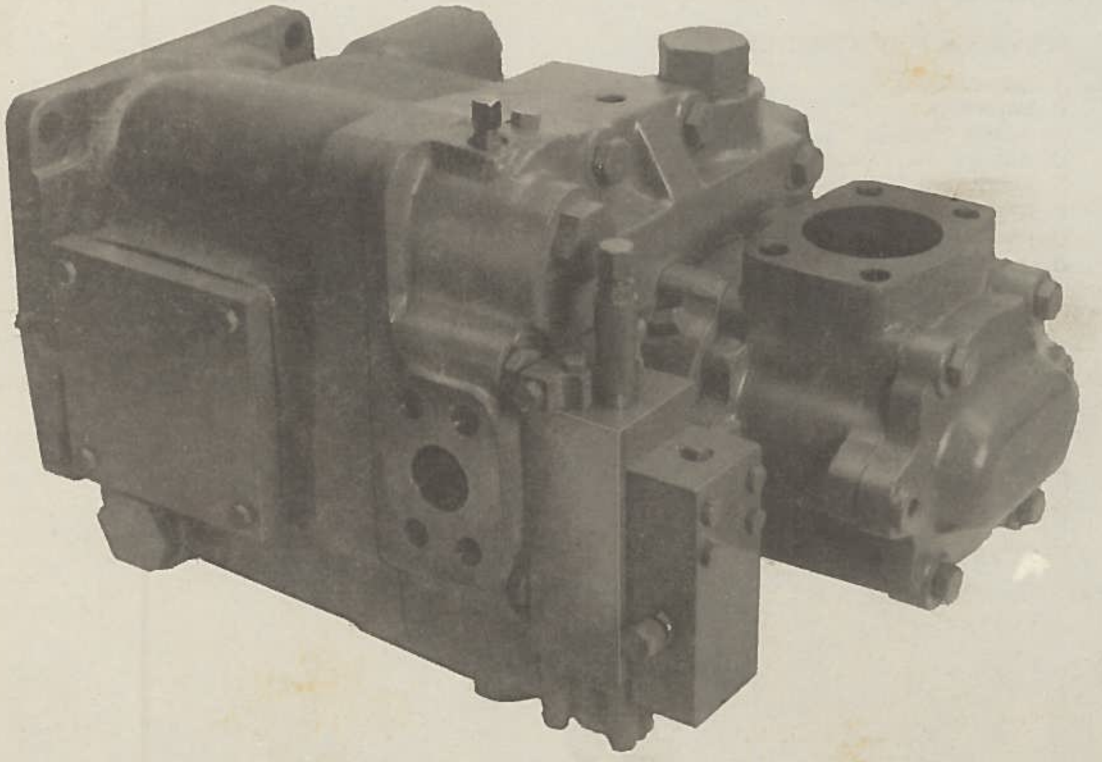
VICKERS®
A TRINOVA COMPANY

Overhaul Manual

**POWER MATCH™
High Pressure
Piston Pumps**

PVD45,
PVD80 &
PVD120

11



Vickers, Incorporated

1401 Crooks Road
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M-2230-S

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MODEL CODE BREAKDOWN

(AS STAMPED INTO NAMEPLATE OF UNIT)

PVD*-********

PUMP

VARIABLE DELIVERY

INLINE SERIES D

FLOW RATING IN USGPM
(AT 1800 RPM)
45 - 45 USGPM
80 - 80 USGPM
120 - 120 USGPM

UNIT ASSEMBLY NUMBER

NOTE
A CROSS REFERENCE BETWEEN UNIT MODEL CODE AND ASSEMBLY NUMBER IS INCLUDED IN CONTROL DRAWING M-2231-S.

Table 1.

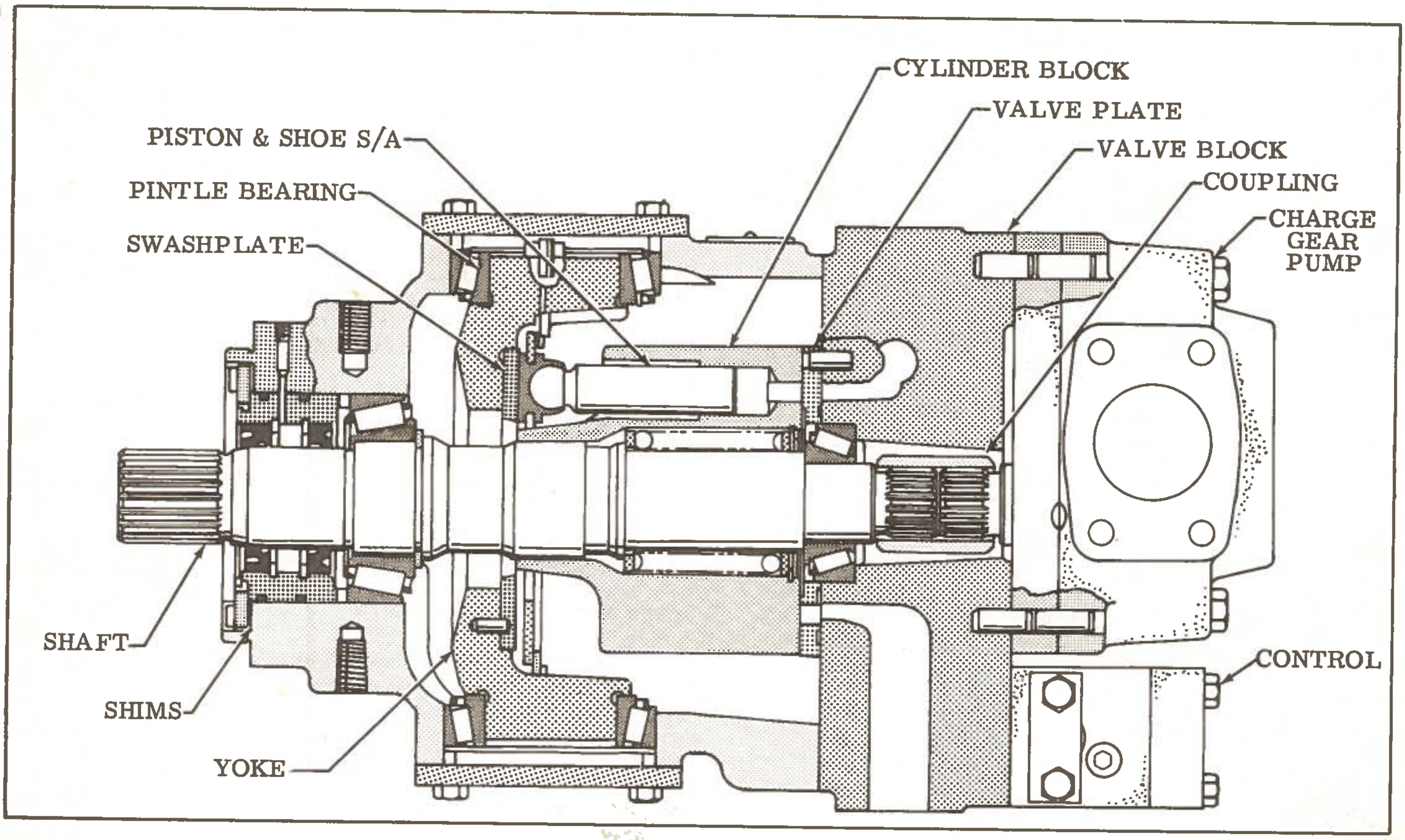


Figure 1. Typical PVD Piston Pump

Section I – INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes the basic operating characteristics and provides service and overhaul information for the PVD series basic pump. Piston pump controls are covered in a separate manual. The information contained herein pertains to the latest design series as listed in Table 1.

B. GENERAL INFORMATION

1. Related Publications – Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 2 are available from any sales engineering office.

2. Model Codes – Variations within each basic model series are covered in the model code. Table 1 is a partial breakdown of the codes covering these units. The basic model and assembly number will be stamped into the nameplate (i.e. PVD45-123456). Service inquiries should always include the unit model code number as stamped on the nameplate.

MODEL	PARTS DWGS.	INSTALLATION DWG.
PVD45	M-2227-S	MB-202
PVD80	M-2228-S	
PVD120	M-2229-S	
Controls	M-2231-S	

Table 2.

Section II – DESCRIPTION

A. GENERAL

Assembly of a typical PVD series piston pump is shown in Figure 1. In general, a piston pump and charge gear pump are connected in tandem on the same shaft. The gear pump provides charge flow to the piston pump inlet. A charge relief valve determines piston pump inlet pressure.

B. CONTROLS

Various controls are available with the PVD series pumps. These controls are covered by a separate service drawing and manual. See Table 1. The following is a brief description of each control:

Standard Pressure Compensator

This control limits system pressure to a desired level and is a standard feature on all pumps. When system pressure reaches the compensator setting, pump displacement starts to decrease to match the load requirements.

The compensator is sensitive to the rate of pressure rise in the system and minimizes pressure overshoot. In a highly responsive system, the pump will begin de-stroking before system pressure reaches the compensator setting. As a result, system shocks which shorten component life and cause leakage are greatly reduced, and in many cases eliminated.

Dual-Pressure Compensator

This control allows a pump to alternately operate between two pressure settings. For example, an excavator may require cylinder pressures limited to 4000 PSIG, but need 5000 PSIG for the propel motors to provide adequate tractive effort. This is easily achieved with a dual-pressure compensator.

Compensator With Remote Pressure Setting

This pressure compensator offers advantages when it is difficult or inconvenient for the vehicle operator to reach the operating pump and adjust the pressure setting. The adjustment for the compensator can be mounted in the vehicle cab or control station where movement of a knob allows the operator to achieve variable control of the compensator setting.

Torque Summation

On vehicles where one engine is driving two pumps, this control assures that pump demands do not exceed available engine torque. The control allows full engine power to be absorbed by either pump but limits the sum of the pump input torques to a level which will prevent engine stall.

Torque Limiter

This control allows maximum performance to be obtained from the vehicle engine. It limits torque at the pump input shaft to prevent engine stall while the pressure compensator limits maximum pressure in the system. When pump input speed remains constant, the torque limiter acts as an input horsepower limiter.

Speed Sensing Control

This control maintains zero displacement of the pump during startup to provide easier engine starting. Also, the control will cause the pump to return to zero displacement if a load causes the engine RPM to decrease below a certain preset level. The speed sensing control is used in place of the torque limit control. The intent of both is to keep the engine from stalling. As load begins to exceed the engine horsepower, engine speed will drop. This is sensed by the control and pump displacement is reduced.

An option provided is a by-pass circuit which permits operation at reduced engine throttle settings.

Load Sensing Control

This control provides a POWER MATCH™ between the pump and load, thereby maximizing system efficiency and improving metering characteristics of the system's directional control valve.

The control senses pump outlet pressure and load pressure, and keeps the difference between these two pressures constant. The differential pressure is measured across a metering land in the system's flow control valve, with the effect that pump flow is determined by valve spool position and is independent of load pressure.

The load pressure signal is generated downstream of the flow control valve metering land, and communicated to the pump's load sensor by a signal line. In a multiple-spool load sensing valve arrangement, the internal logic must sense all load pressures and feed the highest pressure back to the pump control.

C. APPLICATION

Pump deliveries shown in the model code are in USGPM, at 1800 RPM. For flows at other speeds, methods of installation and other application information, sales engineering personnel should be consulted.

Section III – PRINCIPLES OF OPERATION

A. PISTON PUMP

The drive shaft causes the cylinder block, pistons and shoe plate to rotate within the pump. See Figure 2. The angle of the yoke face imparts a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted valve plate. As the pistons move out of the cylinder block, fluid is forced into the void by charge pressure. The fluid moves with the cylinder block past the intake kidney slot to the outlet (pressure) kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

B. CHARGE PUMP

An external gear pump (Figure 3) consists essentially of two meshed gears in a closely fitted housing with inlet and outlet ports opposite each other. One gear is driven by the power source and in turning, drives the other. As the gear teeth separate and travel past the inlet, a partial vacuum is formed. Oil is forced into the inlet by atmospheric pressure and carried to the outlet in pumping chambers formed between the gear teeth and housing. As the gear teeth mesh at the outlet, oil is forced out of the pumping chambers into the outlet port. This oil is used to charge the piston pump inlet.

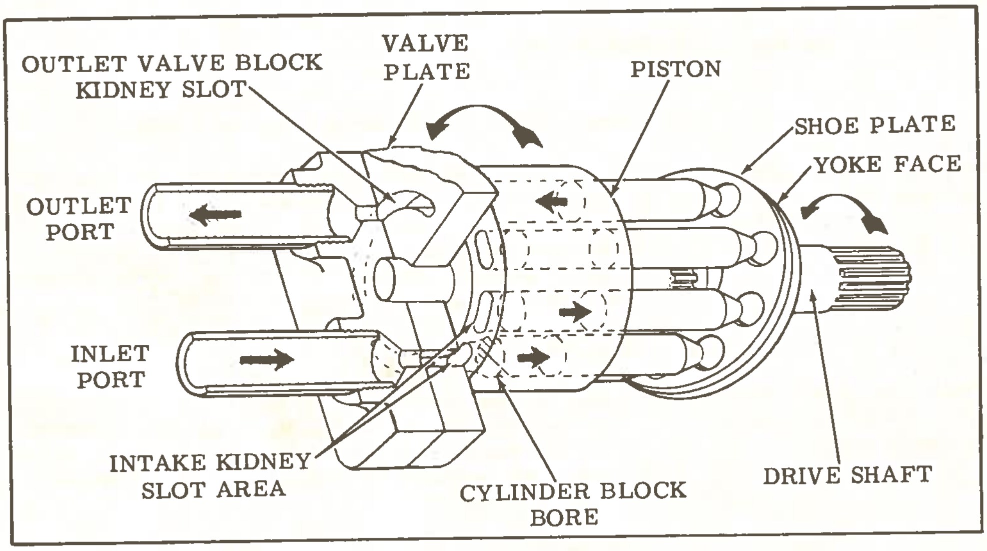


Figure 2. Piston Pump Operation

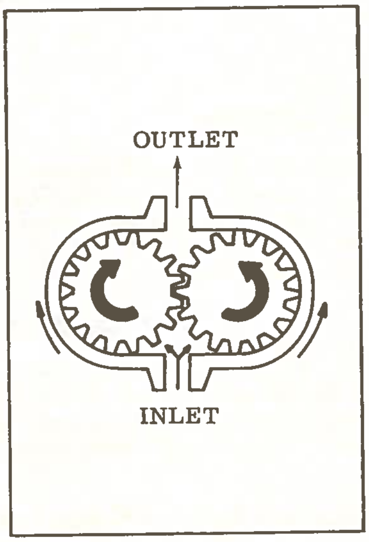


Figure 3. Charge Pump Operation

Section IV – INSTALLATION AND OPERATING INSTRUCTIONS

A. INSTALLATION DRAWINGS

The installation drawing listed in Table 2 will shown operating characteristics, installation dimensions and port locations.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

Pump shafts are designed to be installed in couplings with a slip fit. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawing. See Table 2.

1. Direct Mounting – A pilot on the pump mounting flange (Figure 4) assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be exercised in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without engineering approval.

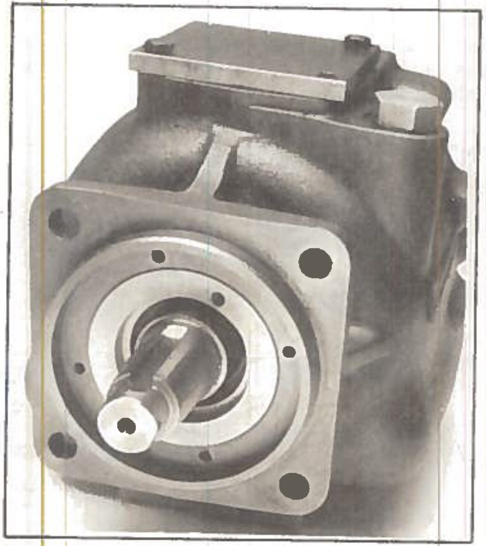


Figure 4. Pump Mounting Flange

C. SHAFT ROTATION

Pumps are assembled for both right-hand (clockwise) and left-hand (counterclockwise) shaft rotation as viewed from the shaft end.

CAUTION

Never drive a pump in the wrong direction of rotation. Seizure will result, necessitating expensive repairs.

D. PIPING AND TUBING

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with clean solvent to remove loose particles.

NOTE

For information on pickling, refer to instruction sheet 1221-S.

2. To minimize flow resistance and the possibility of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube. In high pressure systems (5000 PSI), steel elbows should be used instead of bending tubing; this provides an increase in circuit life.

E. HYDRAULIC FLUID RECOMMENDATIONS

General Data

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Refer to Data sheet M-2950-S for oil selection.

Oil recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended oils or operating conditions, contact your sales engineering representative.

Cleanliness

Thorough precautions should always be observed to insure the hydraulic system is clean.

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc. cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

Sound Level

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Overload protection is required to limit pressure in the system to a prescribed maximum and protect components from excessive pressure.

Experience has shown that on many mobile systems, the PVD series pressure compensator system limits pressure between the pump and directional controls to an acceptable level.

Due to varying system characteristics, it is highly recommended that relief valves be installed in the system.

G. START-UP

With a minimum drive speed of 800 RPM, a pump should prime almost immediately, if provision is made to initially purge the air from the system.

Failure to prime within a reasonable time may result in damage due to lack of lubrication. The pump housing must be filled with fluid and inlet lines must be tight and free from air leaks. It may be necessary to loosen a fitting on the outlet side of the pump to purge air trapped in the system.

Section V – SERVICE AND MAINTENANCE

A. SERVICE TOOLS

The following standard tools for overhauling the piston unit are shown in Figure 5.

1. Torque wrench with short extension and sockets
2. 1″ micrometer
3. 1″ depth micrometer
4. Internal Truarc pliers (2300)
5. External Truarc pliers (0200)

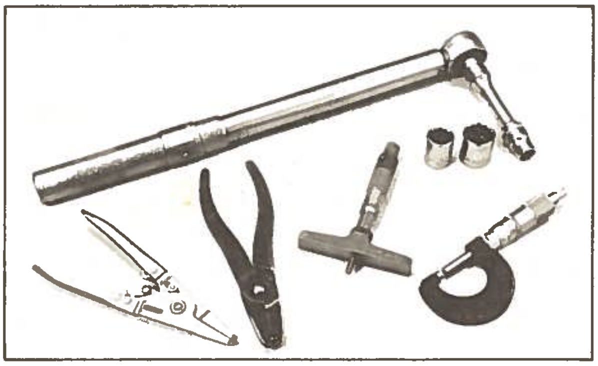


Figure 5. Service Tools

Special Tools

The following special tools are required to service the PVD heavy duty piston pump series.

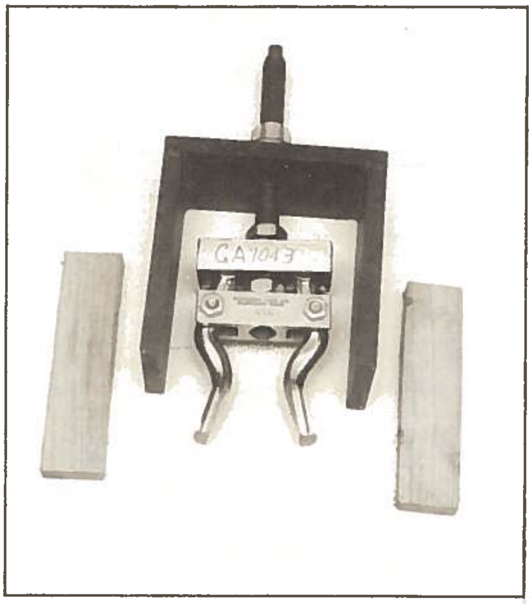
1. Obtain two long screws (tabulated in Table 3). Cut off the heads of the screws to make studs. These studs will be used to assemble and disassemble the valve block.

MODEL	SCREW (2 Req'd.)	DIA. THD.	SAE COARSE
PVD45	214689	0.437-14	CL-2A
PVD80	214776	0.625-11	
PVD120	46671	0.625-11	

Table 3. Special Screws

2. One length of 1/8 inch drill rod approximately 18 inches (457.2mm) long.

3. Valve block bearing race removal tool and shims. (See Figure 6.)



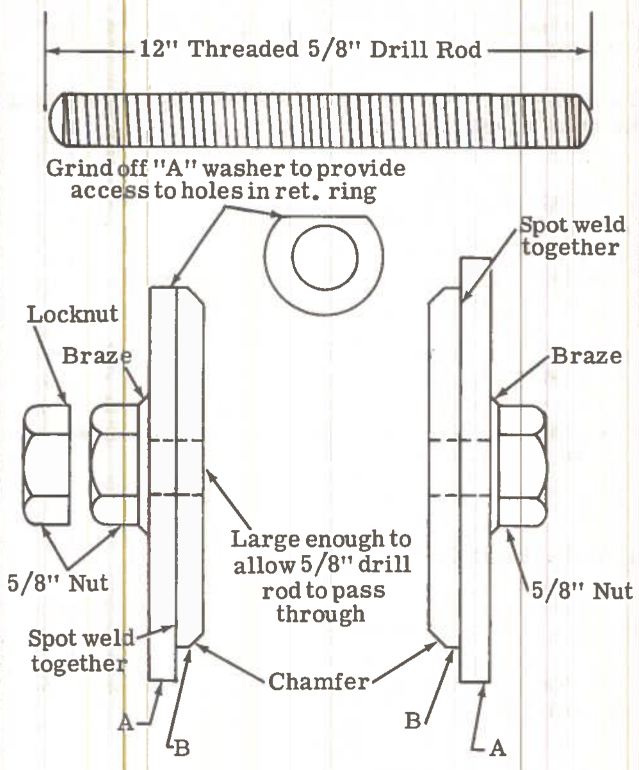
Tool #MD956
This tool is manufactured by:
Owatanna Tool Company
376 North Street
Owatanna, WI 55060

Figure 6. Bearing Race Removal Tool

4. A Torx type TX-30 insert bit is required for removal of outer seal retainer screws on the PVD45 and PVD120 units. The PVD80 uses standard hex head screws.

5. Dial indicator and accessories.

6. Cylinder block disassembly tool. See Figure 7.


12" Threaded 5/8" Drill Rod
Grind off "A" washer to provide access to holes in ret. ring
Spot weld together
Locknut
Braze
Braze
Large enough to allow 5/8" drill rod to pass through
5/8" Nut
5/8" Nut
Spot weld together
Chamfer
A
B
B
A

MODEL	WASHER DIA.	
	A	B
PVD45	2"	1-3/4"
PVD80	2-1/2"	2"
PVD120	2-3/4"	2-1/4"

Figure 7. Cylinder Block Spring Decompression Tool

NOTE

In addition to the above tools, an arbor press is required to service bearings, etc. A chain fall is required to handle the pump and valve block assembly. Repair of this unit is intricate and should not be attempted without the proper tools.

B. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result.

In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. See Table 4.

5. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

C. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a clean fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the pump or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint getting into the system.

D. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driving medium.

E. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

F. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 2.

G. PRODUCT LIFE

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect potential component failure.

H. TROUBLESHOOTING

Table 4 lists the common difficulties experienced with pumps and hydraulic systems. It indicates probable causes and remedies for each of the troubles listed.

TROUBLE	PROBABLE CAUSE	REMEDY
I. Excessive noise in pump.	Low oil level in the reservoir.	Fill reservoir to proper level with the recommended fluid. *Do not* over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	1. Check inlet (suction) lines and fittings for air leaks. 2. Check charge pump.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to operating level.
III. System not developing pressure.	Overload protection improperly set.	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair.
IV. Loss of fluid.	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating sections of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Misadjusted or broken pump control.	Locate and repair. See parts drawing M-2231-S for control information.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 2. Troubleshooting Chart

Section VI - OVERHAUL

A. GENERAL

CAUTION

Block vehicle if it is on a slope to prevent uncontrolled movement.

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure.

Drain oil from the vehicle hydraulic system. Use new clean oil when restoring the unit to service.

Before breaking a circuit connection, hose off or otherwise clean the outside of the unit thoroughly to prevent entry of dirt into the system.

After removing the PVD pump from the vehicle and before disassembly, cap or plug all ports and disconnected hydraulic lines.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Repair of the PVD pump will generally not require disassembly to the extent described here. The sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figures 8, 9 and 10. Special procedures are included in the following steps.

NOTE

Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning the valve poppet and valve block passages.

B. REMOVAL OF CONTROL AND CHARGE PUMP

CAUTION
Use a chain fall to handle the weight of the pump and valve block in the following steps. Thread appropriate eyebolts into the housing and valve block.

1. Set the piston pump on a steel work bench that will support the weight of the unit to be repaired.

2. Insert the chain fall hook into the valve block eyebolt and take up slack. *Do not* lift the pump from the workbench.

3. Remove existing control tubing, then, remove the four control attaching screws (1). Remove control (2) and set aside. Discard interface "O" rings. (Refer to Figure 10.)

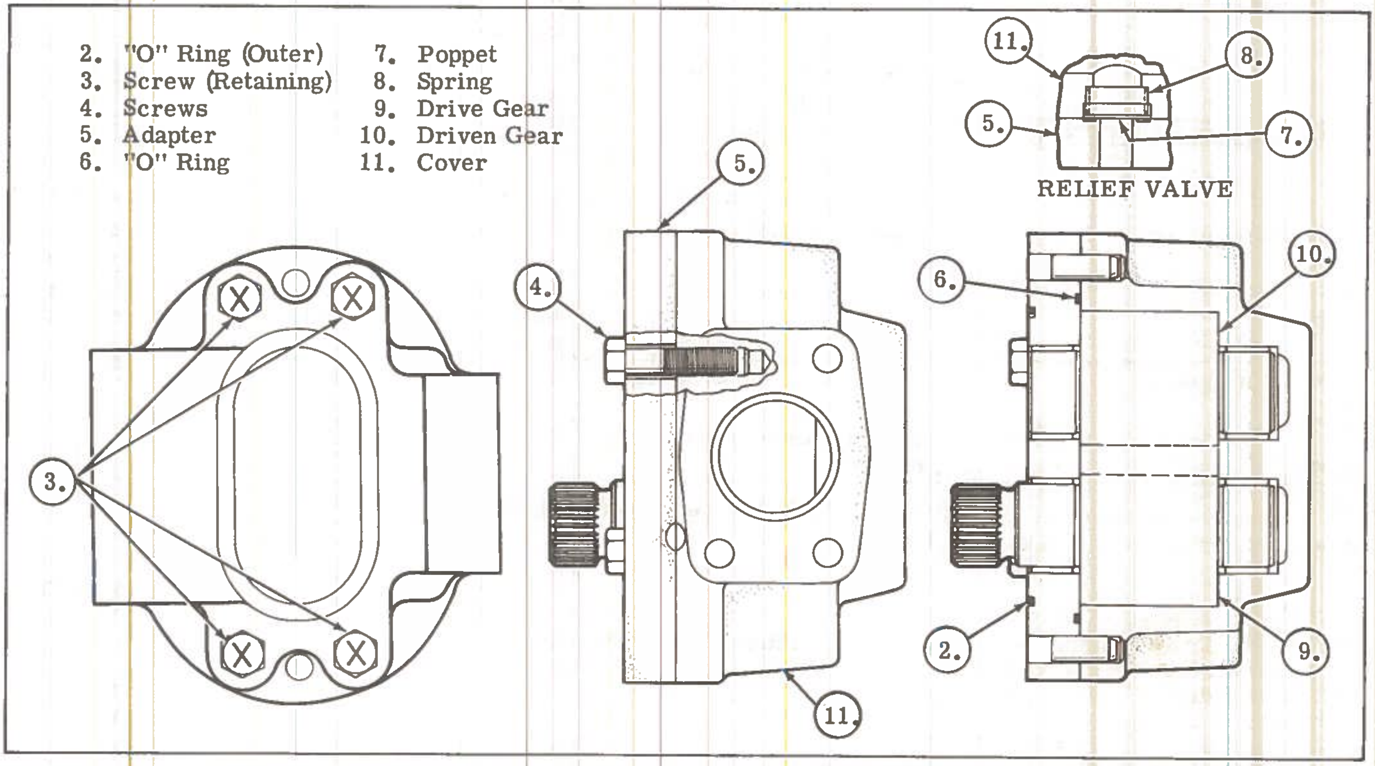


Figure 8. PVD45 Charge Pump

NOTE
This manual does not cover repair of controls. Refer to parts drawing and overhaul manual M-2231-S for this information.

NOTE
Do not disassemble the charge pump except to clean or replace seals. If other problems exist within the pump, replacement of the complete unit is recommended. If the gear pump is opened for cleaning, replace the seals.

4. Remove four retaining screws (3) located in charge pump cover. See Figure 8 for PVD45 units and Figure 9 for PVD80 and PVD120 units. Remove screws indicated by an "X".

5. Slide the charge pump away from the valve block. Discard the outer "O" ring (2) on PVD45 units. Discard the gasket (2) on PVD80 and PVD120 units. The spline coupling (5) (Figure 10) may or may not be removed with the charge pump. Remove spline coupling (5) from the shaft.

NOTE
If further disassembly of the PVD45 charge pump is required, perform steps (6 through 10). If further disassembly of the PVD80 or PVD120 charge pump is necessary, omit steps (6 through 10) and perform steps (11 through 15). If disassembly of the charge pump is not required, omit steps (6 through 15) and proceed to Section VI-E.

6. Place the charge pump in a vise. Use thin plywood shims between the vise and pump to prevent scratching machined surfaces. The spine shaft should point up.

7. Remove four screws (4) that connect adapter (5) to cover (11) on the PVD45 unit, and remove adapter (5) from cover (11) exposing the gears. Discard "O" ring (6).

8. Remove the internal relief valve poppet (7) and spring (8) from their location beneath adapter (5).

NOTE
The poppet (7), spring (8) and seat (part of adapter (5)) form an internal relief valve (5-15 PSIG). The function of this valve is to pressurize the housing, while providing an internal drain path from the housing to the inlet of the charge pump.

9. Remove the drive gear (9) and driven gear (10) from the cover pocket.

10. Clean all gear pump parts and set aside for inspection.

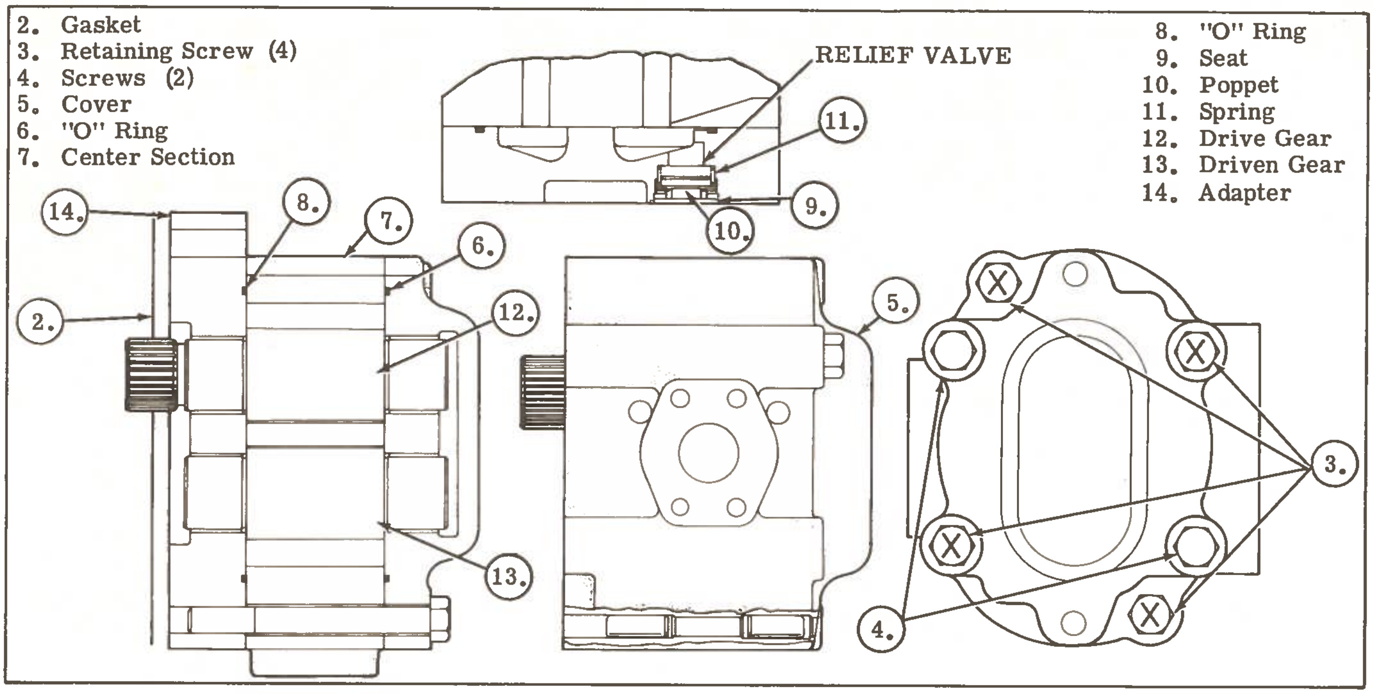


Figure 9. PVD80 and PVD120 Charge Pump

NOTE
The following steps (11) through (15) pertain to disassembly of the PVD80 and PVD120 units. Refer to Figure 9.

11. Install the charge pump into a vise with the jaws holding adapter (14) and the cover (5) pointing up.

12. Remove two retaining screws (4) from cover (5) and separate the cover from the balance of the pump. Discard "O" ring (6).

13. Remove center section (7) from adapter (14). Discard "O" ring (8). *Do not* remove relief valve seat (9) from adapter (14) unless inspection reveals a possible malfunction. Use a small tool to move poppet (10) against spring (11). The poppet should return to the seated position upon release of the tool.

14. Remove drive gear (12) and driven gear (13) from adapter (14).

15. Clean and set parts aside for inspection.

C. INSPECTION, REPAIR AND REPLACEMENT

NOTE
Replace the charge pump if parts do not meet the following specifications.

1. Inspect all components for wear, erosion and/or seizure.

2. Check the center section or cover for porosity, erosion, or heavy wear pattern.

3. Check the shaft splines and gear tips for wear or damage.

4. Check journals for burnishing and heat discoloration.

5. Check cover and adapter for excessive wear in the area of the gears.

D. ASSEMBLY OF CHARGE PUMP

NOTE
Cover the assembly area with clean Kraft paper to prevent contamination of parts.

1. Obtain a seal kit for the unit being repaired. Refer to parts drawing for seal kit information. See Table 2.

2. Assemble the charge pump as follows: Refer to sectional view Figure 8 for PVD45 units and Figure 9 for the PVD80 and PVD120 units.

NOTE
Flood all parts with clean system fluid at assembly. Perform steps (9) through (16) for PVD120 units.

3. Place cover (11) in the jaws of a vise with pocket pointing up. Figure 8 shows the pump assembled in the right hand configuration. Reverse the location of the drive and driven gears (9 and 10) for left hand rotation.

4. Install drive and driven gears (9 and 10) into charge pump cover (11). Make sure gears are located to provide proper shaft rotation for the unit.

5. Lubricate relief valve spring (8) and poppet (7) with system fluid. Assemble spring in place within cover (11) and place poppet on top of spring.

6. Lubricate journals in adapter (5). Install a new internal "O" ring (6). Orient adapter (5) to align pins and relief valve hole with cover (11). Push relief valve down into cover. Insert a cover screw through adapter hole and hold the poppet in position until adapter is in place. *Do not* pinch "O" ring (6). Check movement of poppet with screw after adapter (5) is in place.

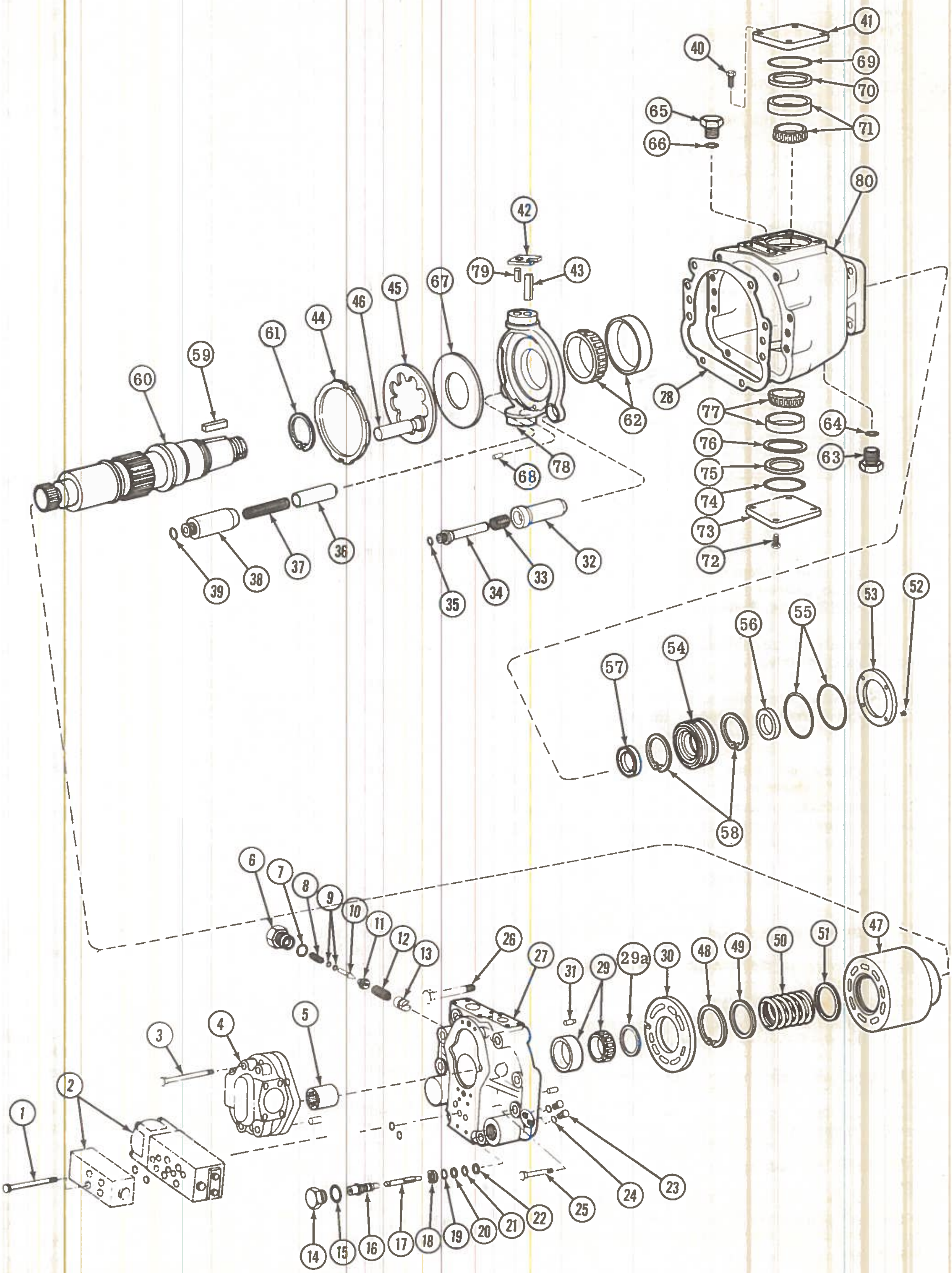


Figure 10. Piston Pump Exploded View (PVD45 shown)

ITEM	PART NUMBER	QTY.	ITEM	PART NUMBER	QTY.
1	Screw	4	41	Cover	1
2	Control	1	42	Pin Lock	1
3	Screw	4	43	Key	1
4	Charge Pump	1	44	Lock Spacer	1
5	Coupling	1	45	Shoe Plate	1
6	Plug	1	46	Piston & Shoe S/A	9
7	"O" Ring	1	47	Cylinder Block	1
8	Spring	1	48	Retaining Ring	1
9	Shims	A/R	49	Washer	1
10	Poppet	1	50	Spring	1
11	Seat	1	51	Washer	1
12	Spring	1	52	Screw	4
13	Valve	1	53	Retainer	1
14	Plug	1	54	Seal Retainer	1
15	"O" Ring	1	55	"O" Ring	2
16	Sleeve	1	56	Outer Shaft Seal	1
17	Spool	1	57	Inner Shaft Seal	1
18	Shims	A/R	58	Retaining Ring	2
19	"O" Ring	1	59	Shaft Key	1
20	Back-Up Ring	1	60	Shaft	1
21	"O" Ring	1	61	Retaining Ring	1
22	Back-Up Ring	1	62	Shaft Bearing	1
23	Plug	2	63	Plug	1
24	"O" Ring	2	64	"O" Ring	1
25	Screw	7	65	Plug	1
26	Screw	1	66	"O" Ring	1
27	Valve Block	1	67	Swash Plate	1
28	Gasket	1	68	Pin	1
29	Tail Bearing	1	69	"O" Ring	1
29a	Spacer	1	70	Spacer	1
30	Valve Plate	1	71	Bearing	1
31	Pin	2	72	Screw	4
32	Bias Piston	1	73	Cover	1
33	Spring	1	74	"O" Ring	1
34	Bias Piston Rod	1	75	Spacer	1
35	"O" Ring	1	76	Shims	A/R
36	Control Piston	1	77	Bearing	1
37	Spring	1	78	Yoke	1
38	Control Piston Sleeve	1	79	Roll Pin	1
39	"O" Ring	1	80	Housing	1
40	Screw	4			

Figure 10. Piston Pump Exploded View Part Nomenclature
(PVD45 shown)

7. Thread four screws (4) through adapter (5) into cover (11). Tighten the screws to 35-45 lb. ft. (47.2-60.8 N.m.)

8. Drive shaft must turn freely by hand after assembly. Install a new "O" ring (2) into adapter (5). Cover the unit to prevent dirt contamination.

9. Place the PVD80 or PVD120 cover (5) in the jaws of a vice with interface pointing up. Figure 9 shows the pump assembled in the right hand configuration. Reverse the location of the drive and driven gears (12 & 13) for left hand units.

10. Install the drive and driven gears (12 & 13) into charge pump cover (5). Make sure of proper shaft rotation for the unit. (See Figure 9.)

11. If the relief valve was removed, install spring (11), poppet (10) and seat (9) as shown in Figure 9. Press seat (9) in place within adapter (14). Check movement of poppet (10) after installation.

12. Install a new "O" ring (6) into the groove of cover (5).

13. Install center section (7) over the gears. Right hand units will have the inlet positioned as shown in Figure 9. Flood gears with system fluid. *Do not* pinch "O" ring (6) during installation.

14. Install "O" ring (8) into adapter (14) and lubricate journals. Orient the adapter to align pins and then install over drive and driven gears (12 & 13) and up against center section (7). Alignment pins will hold adapter (14) and center section (7) in the proper position. *Do not* pinch "O" ring (8) at assembly.

15. Thread the two retaining screws (4) through cover (5) into adapter (14) hand tight. Turn the pump over and place in the vise with the jaws connected to adapter (14). Tighten the two screws to 118-127 lb. ft. (160-172 N.m).

NOTE

Torque required to turn pump after assembly must not exceed 8.85 lb. ft. (12 N.m).

16. Install gasket (2) over alignment pins and set aside for assembly. Cover to prevent contamination from entering unit

E. DISASSEMBLY OF PISTON PUMP

1. Remove charge relief valve parts, items (6 through 13). A small pencil magnet may be found useful during this operation. See Figure 10.

NOTE

Units that do not use the yoke feedback parts will omit the following steps, items (14 through 22) (See Figure 10).

2. Remove yoke feedback parts, items (14 through 22). Use care during removal of sleeve (16) to prevent scoring feedback spool (17).

3. Remove plugs (23) and "O" rings (24). Discard "O" rings.

4. Remove two valve block screws (25) located across from each other. Install the studs noted under special tools for this unit into housing (80). Tighten in place with vise grip pliers.

5. Remove the remaining valve block screws (25) and set aside for inspection.

6. Use the chain fall to help remove the valve block (27) from the housing (80). Slide the valve block away from the housing slowly. Valve plate (30) may stick to cylinder block (47) during removal of the valve block. Be careful not to damage the valve plate, valve block or housing faces during this operation. Once the valve block moves away, do not allow the valve block to move back against the housing as the valve plate may be damaged. Discard gasket (28).

NOTE

In the following step, it is sometimes difficult to remove valve plate (30) from cylinder block (47). If this is the case, remove bearing (29). This allows valve plate (30) to drop down for easy removal.

7. Remove valve plate (30). Remove rear shaft bearing cone (29) and spacer (29a) from shaft (60). Do not remove rear shaft bearing race (29) from the valve block.

8. Remove valve plate pin (31) from the valve block. Do not damage the valve block during removal.

9. Remove bias piston (32) and spring (33). Do not remove bias piston rod (34) and "O" ring (35) unless inspection of the bias rod indicates a problem.

10. Remove control piston (36) and spring (37). Do not remove control piston sleeve (38) and "O" ring (39) unless inspection of the control piston indicates a problem.

11. Remove the four screws (40) which hold the pintle cover (41) to the housing. Remove cover (41). Located under the cover on PVD45 units is a key locking arrangement, items (42 & 79). These will not exist on the PVD80 and PVD120 models. Item (43) is a key that fits in the slot of spacer (44) and retains the rotating group. After removal of the key, replace the pintle cover and screws. Tighten the pintle cover and screws. Tighten the pintle screws hand tight.

12. Reach into the housing with the special length of 1/8 inch drill rod prepared in the special tools section of this manual. Rotate lock spacer (44) with the drill rod to unlock shoe plate (45) from within yoke (78). Reach in with both hands and grab the complete rotating group as a unit and withdraw from the housing.

NOTE

The rotating group consists of the following items: spacer (44), shoe plate (45), 9 piston and shoe S/A (46), cylinder block S/A (47), retaining ring (48), washer (49), spring (50) and washer (51).

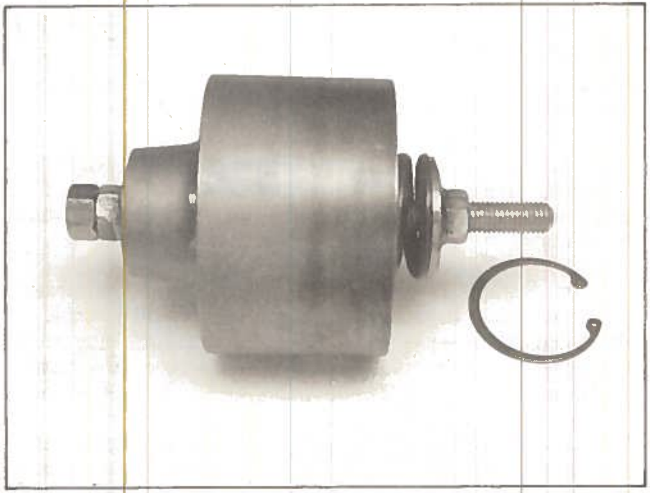


Figure 11.

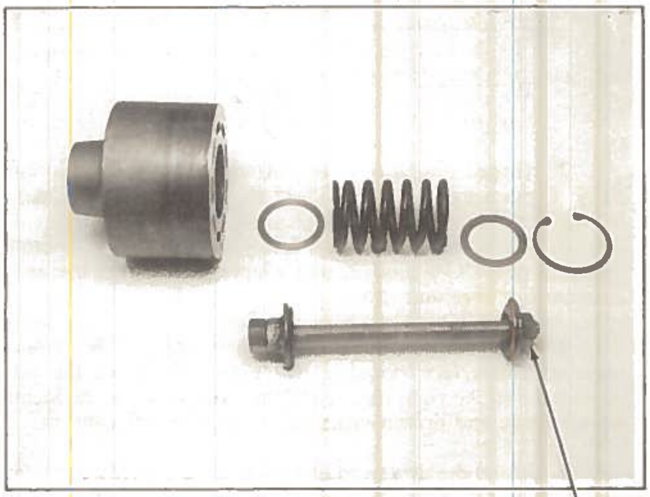


Figure 11a.

See Figure 7 for this tool

Cylinder Block Disasembly Procedure

Install tool with slotted washer toward retaining ring end of cylinder block S/A. Position slot so retaining ring can be removed. Tighten nuts to compress spring and washer. Remove retaining ring. Loosen nuts to relieve spring compression.

CAUTION

Spring (50) located within the cylinder block is under a high compression and can cause bodily harm if retaining ring (48) is removed without adequate caution. See Figure 11 for disassembly instructions.

13. Remove shaft key (59) from shaft (60). Remove the front shaft seal arrangement, items (52 through 58). Disassemble "O" rings (55) and shaft seals (56 & 57) from retainer (54). Discard seals and "O" rings. *Do not* remove retaining rings (58) unless they are defective. PVD45 and PVD120 units require a TX-30 Torx tool for removal of screws (52). See special tools.

14. Remove shaft (60) from housing (80). Slide shaft (60), retaining ring (61) and bearing (62) as an assembly out of the flange end of housing. *Do not* remove retaining ring and bearing from shaft unless inspection determines the parts defective.

15. Remove plugs and "O" rings (63 through 66). Discard "O" rings.

16. Remove swash plate (67) and pin (68) from yoke (78).

NOTE

In the following step, the yoke and bearings may not require removal from the housing. The top yoke bearing (71) can be removed without disturbing the yoke bearing preload adjustment. Inspection of the yoke and top yoke bearing will give an indication of the condition of these parts. If any signs of wear or cracks in the yoke are found, or if the bearing has signs of brinelling, pitting of the rollers or demonstrates roughness when turned in the race, remove both bearings and the yoke for further inspection. If the yoke is replaced, a yoke bearing preload adjustment must be performed at assembly. Each set of pintle parts must be kept separated from each other during the following inspection. Pintle bearings may show marks caused by static loading of roller and race. These marks are called "false brinelling" by the manufacturer. If rotation of the bearing within its race is smooth, the bearing is usually serviceable even though it may appear bad.

17. Remove the four screws (40) and cover (41). Remove parts (69 through 71). Inspect the bearing and yoke as noted above. If found defective, remove parts (72 through 79) from housing (80). If the bearing and yoke are found serviceable, install bearing (71), bearing spacer (70), cover (41) and screws (40) back into the housing. Thread screws (40) hand tight. Do not remove special valve block alignment screws during inspection. They will be used to assemble the unit.

F. INSPECTION, REPAIR AND REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. Clean all removed parts, using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning valve block passages, cylinder blocks, etc.

NOTE

Shaft (60) on the PVD45 model was changed to allow easier shimming at the rear bearing on the -23 design instead of the front bearing as on the older -22 design. The new shaft can be used to repair the -22 design, if necessary, when spacer (29a) is used. Follow shimming procedure G9.

Refer to Service Drawing M-2239-S for shim kits.

1. Inspect all screws for burrs, broken or stripped threads and worn corners on the hex head. Use an India stone to clean up burrs. If threads or hex heads are defective, replace the screw.

2. Inspect coupling (5) for worn and broken splines. Replace coupling if defective.

3. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs. If threads are defective, replace the plug.

4. Inspect springs for wear and damaged coils. Replace spring if worn or damaged. Inspect springs for distortion. The ends of the spring must be parallel to each other and ground square with axis within 3°. Replace if distorted.

5. Inspect charge relief valve poppet (10) for wear. Replace if worn.

6. Inspect charge relief valve seat (11) for wear and erosion. Replace if defective.

7. Inspect the charge relief valve (13) for wear, galling, erosion and burrs. If wear is found, replace the part. Check wear by inserting the valve into the valve block bore. Move the part in and out while rotating through 360°. If the valve hangs up or binds, use an India stone on the exterior of the valve to eliminate any possibility of burrs. Check the bore of the valve block for scratches and worn areas. Replace both the valve block (27) and relief valve (13) if parts are found defective.

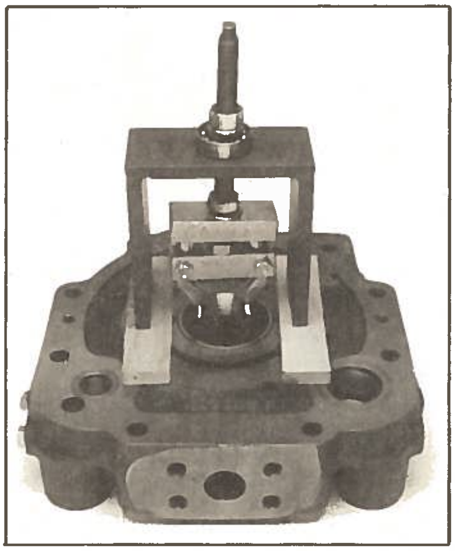


Figure 12. Removal of Bearing Race from Valve Block

8. Inspect feedback spool (17) for scratches on exterior of the lands. If scratches are found, replace spool (17) and sleeve (16) as a subassembly. The spool and sleeve are critical parts and cannot be replaced individually. Feedback spool subassemblies are tabulated on the control parts drawing. See Table 2.

9. Inspect bearings (29, 62, 71 & 77) for brinelling, pitting of rollers and roughness when turned in the bearing race. If a bearing is defective, both the bearing cone and bearing race must be replaced. If bearing race located in valve block (27) requires removal, refer to the procedure shown in Figure 12.

10. Inspect the bronze surface of valve plate (30) for excessive wear, scoring, or heavy erosion. If any of these conditions are noted, replace the valve plate. In most cases, the bronze surface will have a slight circular wear pattern and brown, burnishing areas. This is normal. The overall condition of the valve plate is attributed to the amount of service life, system fluid conditions and actual operating conditions of the pump.

11. Inspect bias piston (32) and bias rod (34) for proper fit. Make sure the parts fit together without binding. Also, make sure the end of bias piston (32) is not worn at the area of yoke (78) contact. If wear is found, check yoke (79) ball socket for bind. The yoke ball should rotate freely a total of 17.5° spherical without binding.

12. Inspect control piston (36) and sleeve (38) as noted in previous step.

13. If yoke (78) was removed from housing (80), check for wear at the area of the yoke pintles (yoke bearing area). Check yoke for stress cracks. Replace yoke if wear or cracks are found. If yoke is replaced on a PVD45 unit, install a new roll pin (79) into the yoke pintle.

14. Inspect pintle cover(s) (41) and (73) if removed. Check for flatness and burrs. Remove burrs with an India stone.

15. Inspect lock spacer key (43) for wear. Replace if worn or deformed.

16. Inspect lock spacer (44) for excessive wear, heavy scratches and burrs. Replace if the part shows evidence of wear. Remove burrs with an India stone.

17. Inspect shoe plate (45) for cracks and heavy wear. If wear is evident, replace the part. The PVD45 shoe plate is shown in Figure 10. PVD80 and 120 shoe plates differ from the one shown. PVD80 and 120 shoe plates have nine circular openings instead of the nine half circles of the PVD45 shoe plate.

18. Inspect cylinder block (47) for wear, scratches and/or erosion between cylinders. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (46) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston, lubricate with clean system fluid and try again. Even minor contamination of the fluid could cause the piston to freeze up within the cylinder block bore.

19. Check retaining ring (48), washer (49), spring (50) and washer (51) which were removed from the cylinder block for wear and burrs. Replace if defective.

20. Inspect each piston shoe subassembly (46) for a maximum end play of 0.003 inch (0.0762 mm); also, check for freedom of movement of the shoe. The shoe must be free to rotate through 17° minimum (spherical). Replace the complete set of piston/shoe subassemblies if one is defective.

21. Check retainer (53) for burrs and heavy scratches. Remove scratches and burrs with an India stone or small file.

22. Check inner seal retainer (54) for burrs, especially check "O" ring groove areas. Remove burrs with an India stone.

23. Do not remove retaining rings (58) from within seal retainer (54) unless they are bent or broken.

24. Inspect shaft key (59) for evidence of wear. Replace if worn.

25. Inspect shaft (60) for wear and chipped splines, also check for wear in the area of the shaft seal. If the shaft is worn more than 0.005 inch (0.127 mm) total indicator reading (TIR), replace the shaft. Do not remove retaining ring (60) from the shaft unless it shows evidence of wear or the shaft requires replacement.

26. Inspect swash plate (67) for wear, pickup, heavy scratches and excessive wear. Replace the swash plate if evidence of wear is shown or if piston shoe wear was noted in step **F**.20.

27. Inspect pin (68) and two spacers (70 & 75) for burrs. Clean up with an India stone.

28. *Do not* remove roll pin (79) from yoke (78) on PVD45 models unless damaged or the yoke is replaced.

29. Inspect housing (80) for burrs, nicks, cracks, cross threads and wear in the area of the pintle bearings. Check each pintle face for flatness and burrs. Inspect mounting face for deep scratches that could cause leakage past the gasket. Clean up burrs and small scratches with an India stone.

G. ASSEMBLY OF PISTON PUMP

1. If yoke (78), pintle bearings (71, 77) or housing (80) are replaced, obtain a new shim kit and perform the pintle bearing preload shimming procedure (steps a through k).

a. Insert the yoke (78) into housing (80) so that both yoke hubs are centered at pintle opening of housing.

b. Lubricate bearing cones (71, 77) with clean system fluid. Install the bearing cones into housing and onto yoke hubs.

c. Install matching bearing races (71, 77) into housing opening over the bearing cones. *Do not* force the bearing races into housing.

d. Position the housing (80) so that the pin hole at end of yoke hub is exposed.

e. Assemble spacer (70) on top of bearing race (71). Install "O" ring (69) into housing groove. Fasten the pintle cover (41) to housing with four screws (40). Tighten the screws to value noted in Table 5.

MODEL	TORQUE SCREWS TO:	
	N.m	lb. ft.
PVD45	14.7 - 16.9	10.8 - 12.5
PVD80	41 - 49	30.2 - 36.1
PVD120	40 - 50	29.5 - 36.9

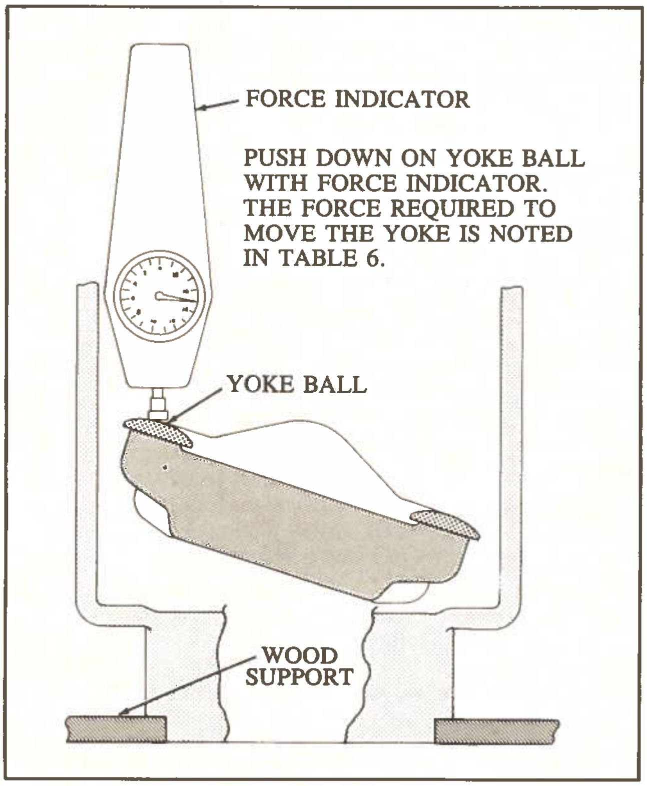
Table 5. Pintle Cover Screw Torque

f. Reposition the housing to assemble the other pintle parts. Install approximately .025/.027 shim (76) thickness on top of bearing race (77). Install spacer (75). Install "O" ring (74) into housing groove. Assemble pintle cover (73) onto housing with four screws (72). Tighten the screws to value noted in Table 5.

g. Place the housing mounting surface on a suitable workbench. See Figure 13.

h. Push the yoke up and down two or three times by hand.

i. Place a force indicator at highest yoke ball location. See Figure 13. Apply force to the yoke ball and observe the force required to start yoke movement. The force required to move the yoke is noted in Table 6. If the force is too high, the shim (76) thickness must be reduced. If the force is too low, the shim (76) thickness must increase. (NOTE: One pound of force equals approximately .001 shim thickness.)



PUSH DOWN ON YOKE BALL WITH FORCE INDICATOR. THE FORCE REQUIRED TO MOVE THE YOKE IS NOTED IN TABLE 6.

Figure 13. Force Measurement

MODEL	FORCE	
	Newtons (N)	Pounds (lb.)
PVD45	44.5 - 66.75	10 - 15
PVD80		
PVD120		

Table 6. Force Required To Move Yoke

j. Repeat steps 'h' and 'i' if necessary. Adjust shim (76) thickness to Table 6.

k. Remove pintle cover (41) so that pin hole in yoke hub is exposed.

2. Install swash plate pin (68) into yoke (78) and assemble swash plate (67) in place over the pin. Check height of pin in yoke and depth of hole in swash plate. There should be clearance to allow swash plate to set flat against yoke surface. Make sure swash plate pin hole is aligned properly with the pin before assembly.

3. Install "O" rings (66 & 64) over plugs (65 & 63 Lubricate and thread plugs into housing (80). Tighten plugs the value noted in Table 7.

MODEL	PLUG TORQUE	
	N.m	lb. ft.
PVD45	140 - 150	103 - 111
PVD80	129 - 142	95 - 105
PVD120	170 - 190	125 - 140

Table 7. Housing Plug Torques

NOTE

Perform the following step if bearing (62) was removed from shaft (60) during inspection. Omit the following step if bearing was not removed from the shaft.

4. Install retaining ring (61) in place on shaft (60).

a. Press bearing (62) on shaft (60). Make sure small end of cone points toward end of shaft at completion of press. Use an arbor press for this operation.

b. Clean bearing with a solvent compatible with system fluid. Lubricate and set bearing race in place over the cone.

c. Rotate the bearing race and cone to verify freedom of movement and smooth operation. Bearing must not bind or have a feeling of roughness.

NOTE

If bearing race (29) was removed from valve block (27), press a new bearing race in place as noted in the following step. If the bearing race is in place within the valve block, omit the following step.

5. Position valve block (27) on the clean surface of an arbor press. Use a piece of wood to protect lower surface of valve block. Position new bearing race (29) with small I.D. facing into valve block. Press in place. Use a suitable socket wrench or piece of hardwood as a pressing tool. Press bearing race (29) into valve block until it bottoms against shoulder.

6. Install shaft (60) with bearing into flange end of housing (80).

7. Install "O" rings (55) and retaining rings (58) (if removed). Install appropriate shaft seals (56 & 57). Single shaft seal units will use seal (57) only. The spring loaded member of seal (56) is pointing out of the pump. The spring loaded member of seal (57) points into the pump. Lubricate shaft seals and "O" rings with system fluid and install inner seal retainer (54) in place within the pump. Use a layer of plastic tape over shaft splines to prevent cutting the seals.

8. Install the outer seal retainer (53). Thread screws (52) through outer seal retainer (53) and into housing (80). Cross tighten the screws to value indicated in Table 8.

MODEL	TORQUE SCREWS TO:	
	N.m	lb. ft.
PVD45	7 - 9	5.1 - 6.6
PVD80	20 - 25	14.8 - 18.4
PVD120	11 - 13	8.1 - 17.0

Table 8. Torque Retainer Screws (52) As Indicated

9. Obtain a spacer kit and perform the shaft end play shimming procedure (steps 'a' through 'l').

a. Select the thinnest spacer (29a) from the spacer kit and install it on end of shaft.

b. Install tail bearing cones (29) on end of shaft against spacer (29a).

c. Install gasket (28) onto pump housing (80).

d. Install valve block (27) on housing. Secure the valve block with screws (26). Tighten the screws to value noted in Table 9.

MODEL	VALVE BLOCK SCREW TORQUES	
	N.m	lb. ft.
PVD45	47.5 - 54.2	35 - 40
PVD80	180 - 200	133 - 147.5
PVD120	251 - 278	185 - 205

Table 9. Valve Block Screw Torque

e. Position the unit so that the shaft (60) is in a vertical position.

f. Rotate the shaft by hand and lift up and down on the shaft to seat the bearings.

g. Place a dial indicator at end of shaft and measure shaft movement. Repeat this step two times to obtain an average reading.

h. Remove the valve block (27), tail bearing cone (29) and spacer (29a).

i. Select the proper spacer thickness from spacer kit to obtain .001-.004 shaft end play.

j. Install spacer (29a) on end of shaft.

k. Repeat steps 'b' through 'g'. Perform steps 'h' through 'j', if required, until .001-.004 shaft end play is obtained.

l. Remove valve block (27), gasket (28), bearing cone (29) and spacer (29a). Set these parts aside.

10. Assemble rotating group as follows:

NOTE

If cylinder block (47) was disassembled during inspection, install washer (51), spring (50), washer (49) and retaining ring (48). Refer to Figure 11 and reverse removal procedures. *Make sure* that sharp edge of retaining ring (48) points outward and is seated properly within its groove before removing threaded tool from cylinder block.

a. Set cylinder block (47) on a clean surface. Use Kraft paper between cylinder block face and work bench to prevent scratching the machined surface. Lubricate cylinder block bores with system fluid.

NOTE

In the following step, make sure lock spacer (44) is positioned properly for insertion of lock key (43). The lock key fits into the off center slot of the lock spacer. If in doubt, insert lock spacer into yoke (78) without rotating group to verify correct orientation.

b. Place lock spacer (44) on top of cylinder block (47) then install nine piston and shoe subassemblies (46) with shoe plate (45) into the cylinder block. See Figure 10. Piston shoe subassemblies and shoe plates differ between the PVD45 and the PVD80/120 units. The PVD45 uses a scalloped shoe plate and the PVD80/120uses a full round hole type shoe plate. The PVD45 scalloped shoe plate assembles into a groove located in the side of each shoe. The PVD80/120 shoe plate assembles behind the shoes (between shoe and cylinder block).

NOTE

The rotating group should be installed in the horizontal plane.

c. Install the complete rotating group over the shaft end and slide the group forward until the shoes rest against swash plate (67) located within yoke (78). Rotate slightly to align spline of shaft to cylinder block.

d. Use special tool (a length of 1/8" drill rod) to position lock spacer (44) into yoke (78). Turn lock spacer with tool until its slot is in line with key (43). Insert key (43). Verify that key is located within the slot. This is very important. If the key is not positioned properly, destruction of the pump may result at start-up. (NOTE: PVD45 units have an additional pin lock (42) and roll pin (79) arrangement. Install pin lock (42) over key (43). Then install roll pin (79)). Install pintle cover (41) and screws (40). Tighten screws to value noted in Table 5.

e. Install spacer (29a) in place on the shaft. Then install bearing cone (29) on the shaft.

11. Assemble valve block (27) to housing as follows:

NOTE

If bias piston rod (34) and control piston (38) were removed from valve block (27), perform the following steps 'a' and 'b'. If the parts were not removed from valve block (27), omit the following two steps and perform step 'c'.

a. Install a new "O" ring (35) on bias piston rod (34). Thread the bias piston rod into valve block (27) and torque to value noted in Table 10.

MODEL	TORQUE	
	N.m	lb. ft.
PVD45	203	150
PVD80	240 - 260	177 - 192
PVD120	300 - 350	221 - 258

Table 10. Piston Rod Torque

b. Install a new "O" ring (39) on control piston (38). Thread the control piston into valve block (27) and torque to value noted in Table 10.

c. Install bias piston spring (33) and bias piston (32) over bias piston rod (34).

d. Install control piston spring (37) and control piston rod (36) within control piston (38).

e. Install valve plate pin (31) into valve block (27). Install valve plate (30) over the valve plate pin. (Use grease on the back side of valve plate to prevent separation from valve block during installation.) Make sure valve plate is flush against the valve block. Lubricate face of the valve plate with system fluid and then lubricate cylinder block (47).

CAUTION

In the following step *do not* allow valve plate (30) to touch cylinder block (47) and then back away. Valve plate (30) may adhere to the cylinder block and if pulled away, can fall out of position with valve plate pin (31). If valve block (27) is then moved against housing (80), damage to valve plate and cylinder block may result.

f. Install gasket (28) over the two alignment studs. Position valve block (27) on alignment studs and slide up against housing (80). Make sure shaft (60) is aligned with bearing and does not hit against the valve plate during installation. Thread screws (25 & 26) through valve block and into housing (80). Remove alignment studs and replace them with the appropriate screws. Tighten valve block screws to value noted in Table 9.

12. Install a new shaft key (59) into the end of shaft (60). Turn piston pump from the vertical position and set it on the workbench with shaft in the horizontal position.

NOTE

At this time, turn the pump shaft in both directions with a wrench. There should be a slight breakaway torque and the shaft should turn free in both directions. If there is resistance to turning in either direction, investigate.

NOTE

The following steps 13 and 14 will vary with different control arrangements. Perform these steps as required for your control. Refer to control parts drawing M-2231-S.

13. Assemble "O" rings (24) on plugs (23) and thread plugs into valve block (27). Torque plugs to 15-18.4 lb. ft. (20-25 N.m).

14. Assemble items (22 through 19) on sleeve (16). Assemble all shims (18) over sleeve. Lubricate seals with system fluid and insert sleeve (16) into valve block (27). Insert feedback spool (17) into sleeve (16), with short land pointing out of valve block. Refer to Figure 10. Install a new "O" ring (15) on plug (14). Lubricate and thread plug (14) into valve block over sleeve (16). Tighten plug (14) to the value noted in Table 11. Final adjustment of feedback spool shims will be accomplished during test.

MODEL	PLUG TORQUE	
	N.m	lb. ft.
PVD45	244 - 257.6	180 - 190
PVD80	300 - 330	221 - 243
PVD120	130 - 140	96 - 103

Table 11. Feedback Spool Plug Torque

15. Assemble the charge relief valve parts as follows:

a. Lubricate and install spring (12) into piston (13). Slide piston and spring into valve block (27).

b. Assemble "O" ring (7) on plug (6). Assemble spring (8) into plug (6). Assemble shims (9) over poppet (10). Insert poppet into spring, located in plug (6). Thread seat (11) into plug (6). Tighten seat (11) into plug to the values noted in Table 12.

MODEL	SEAT TORQUE	
	N.m	lb. ft.
PVD45	14 - 18	10 - 13
PVD80	12 - 15	8.85 - 11
PVD120	31 - 37	23 - 27

Table 12. Charge Relief Valve Seat Torque

c. Install plug (6) into valve block (27). Make sure spring guide portion of seat is located within spring (12) at assembly. Torque plug (6) into valve block (27). The torque figures are the same as for the feedback spool plug shown in Table 11.

16. Assemble the charge pump to the piston pump as follows:

a. Clean the charge pump pad located on the valve block. Make sure the area of contact is clean.

b. Install coupling (5) over end of piston pump shaft (60).

c. Install charge pump assembly and seal (4) to the valve block (27). Install screws (3) and tighten to value noted in Table 13.

MODEL	SCREW TORQUES	
	N.m	lb. ft.
PVD45	46 - 48	34 - 35.4
PVD80	180 - 200	132.8 - 147.5
PVD120	160 - 172	118 - 127

Table 13. Charge Pump Screw Torque

17. Assemble control (2) to valve block (27) with screws (1). Be sure to assemble various control sections in the order of removal. Make sure control seals are in place before installation. Install control tubing in place. To check orientation of control, refer to control parts drawing M-2231-S.

Section VII – TEST PROCEDURE

NOTE

Due to the nature of the PVD heavy duty piston series, the use of a hydraulic pump control is mandatory. Refer to controls drawing and overhaul manual M-2231-S for appropriate control parts and testing of PVD piston units with controls.

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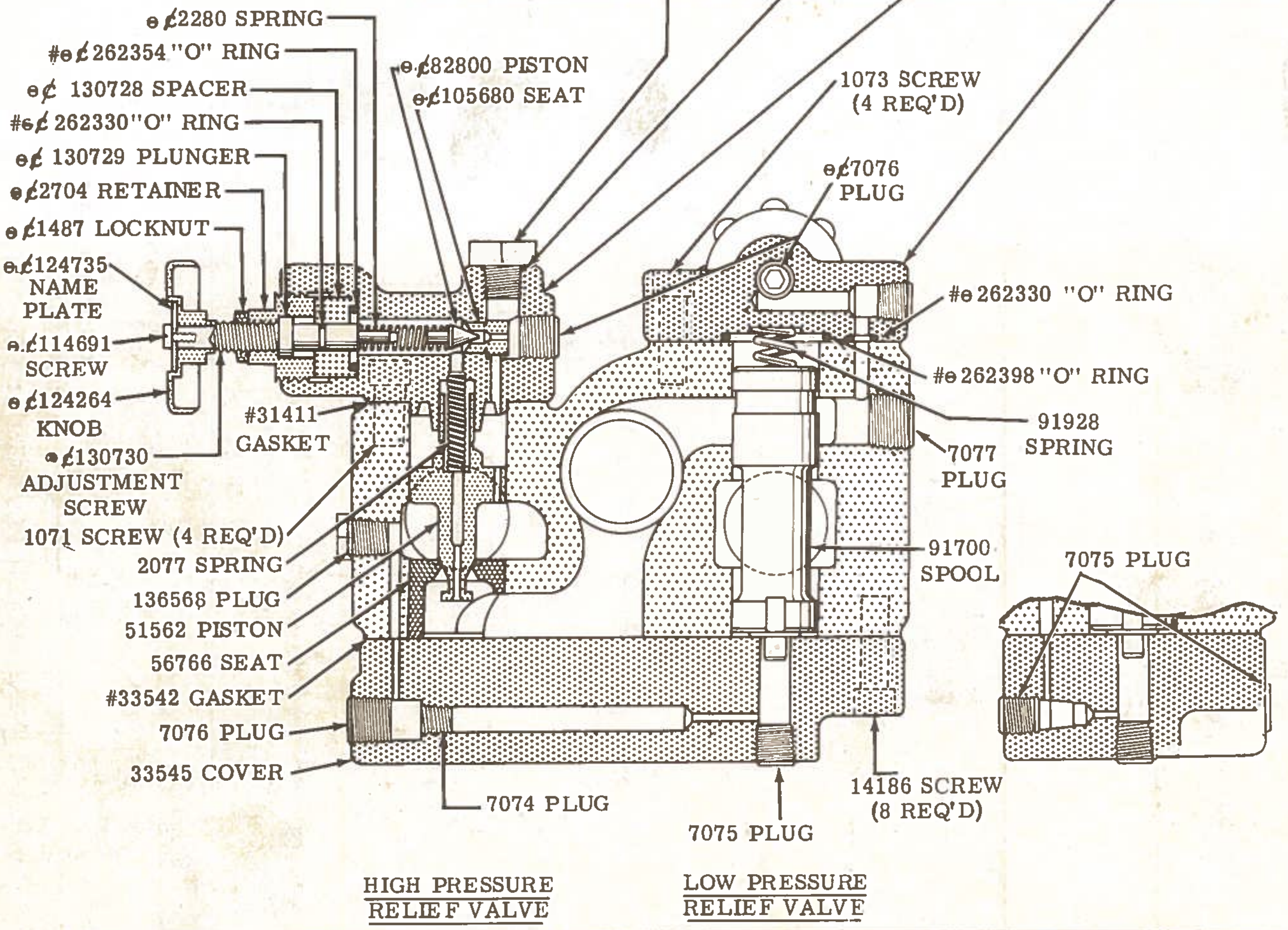
6 COMBINATION
FOR -5 DESIGN LARGE SIZE VC SERIES (FOR CHECK VALVE PARTS, SEE PAGE 1)

ɵ	INCLUDED IN COVER KIT 925328
¢	INCLUDED IN COVER KIT 925329
ɵ ¢	INCLUDED IN BOTH COVER KITS
#	INCLUDED IN GASKET KIT 919307

ɵ ¢ ALL PARTS SO MARKED ARE THE SAME IN EACH COVER KIT

PUMP TYPE (See Model Code)	PLUG	"O" RING	HIGH PRESSURE		LOW PRESSURE	
			COVER	¢ KIT	COVER	ɵ KIT
VC, VCK	ɵ ¢ 7075	———	¢ 131218	925329	ɵ131247	925328
VCS, VCKS	181728	# 263496	183658	———	185129	———



MODEL CODE BREAKDOWN

VC (*)(*) - * * * - * - * D * - 5

DOUBLE PUMP COMBINATION TYPE

K - SHORT SHAFT FOR MOTOR MOUNTING
S - STRAIGHT THREAD CONNECTIONS

TYPE OF MOUNTING AND HIGH PRESSURE PUMP CAPACITY (SEE CARTRIDGE TABLE)
-29, -39, -49 - NO MOUNTING
-128, -138, -148 - FOOT MOUNTING
-129, -139, -149 - FLANGE MOUNTING

LOW PRESSURE PUMP CAPACITY (SEE CARTRIDGE TABLE)
A, C, D, E, G, Y,

DESIGN

UNLOADING OR LOW PRESSURE RELIEF VALVE RANGE
A - 75-250 PSI
B - 125-500 PSI
D - 250-1000 PSI
Z - 30-125 PSI

HIGH PRESSURE RELIEF VALVE RANGE
D - 75-1000 PSI

COMBINATIONS
3, 6, 9, 13, 16, 23, 26

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3, 9, 13, 16, 23 AND 26 COMBINATIONS

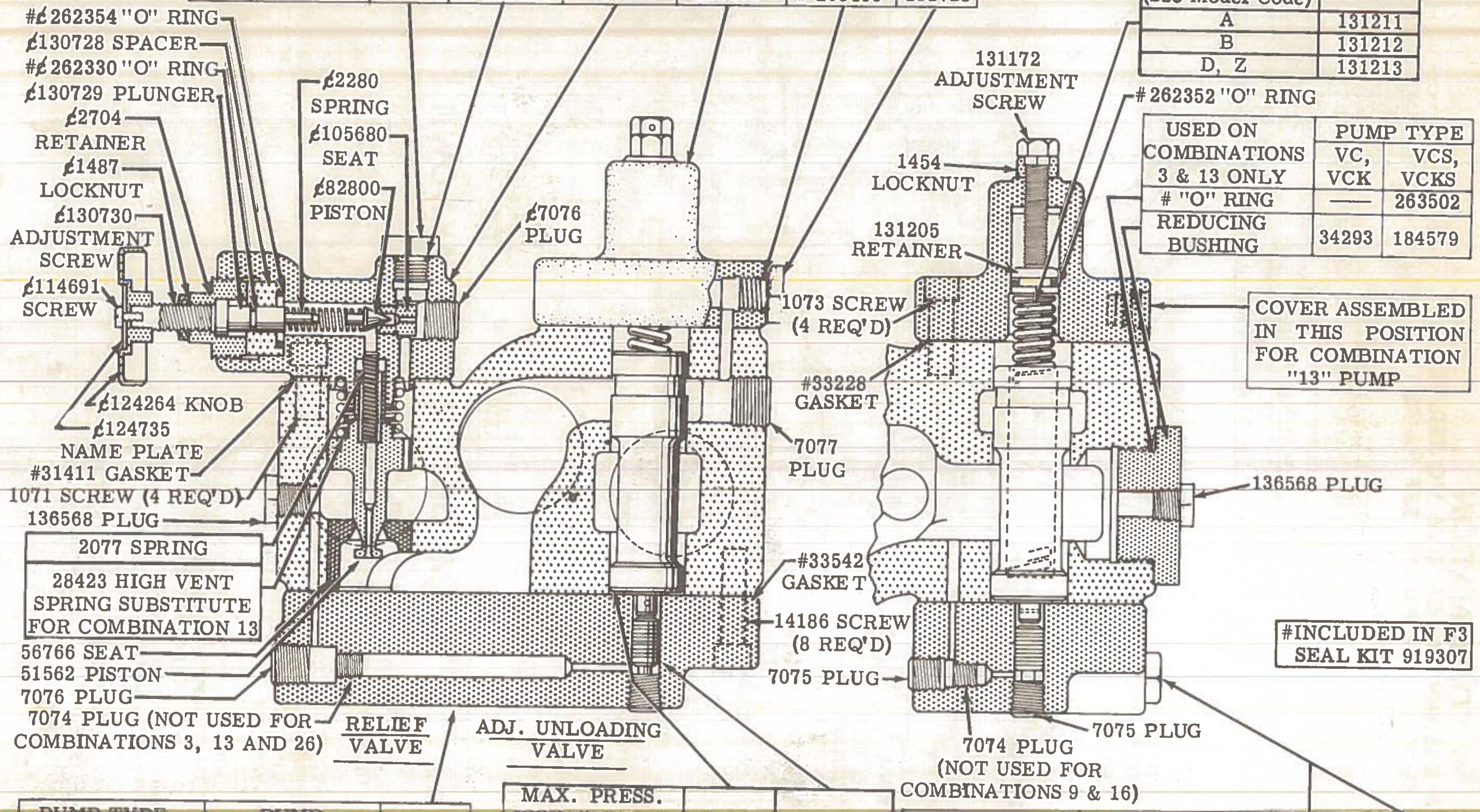
FOR -5 DESIGN LARGE SIZE VC SERIES

¢ INCLUDED IN COVER KIT 925329

PUMP TYPE (See Model Code)	PLUG	"O" RING	COVER HIGH PR.	COVER LOW PR.	"O" RING	PLUG
VC, VCK	¢ 7075	——	¢ 131218	131204	——	7075
VCS, VCKS	181728	# 263496	183658	185478	# 263496	181728

MAX. PRESS. CODE LETTER (See Model Code)	SPRING
A	131211
B	131212
D, Z	131213

USED ON COMBINATIONS 3 & 13 ONLY	PUMP TYPE VC, VCK	PUMP TYPE VCS, VCKS
# "O" RING	——	263502
REDUCING BUSHING	34293	184579



COVER ASSEMBLED IN THIS POSITION FOR COMBINATION "13" PUMP

#INCLUDED IN F3 SEAL KIT 919307

PUMP TYPE (See Model Code)	PUMP COMBINATION	COVER
VC, VCK	3, 9, 13, 23	33545
	16, 26	42191
VCS, VCKS	3, 9, 13, 23	182866
	16, 26	184678

MAX. PRESS. CODE LETTER (See Model Code)	SPOOL	PLUNGER
A, B, D	33250	22226
Z	36738	——
COMB. 16-26 A, B or D	36738	22226

PUMP TYPE (See Model Code)	COMBINATION	PLUG	"O" RING
VC, VCK	3, 9, 13, 16, 26	7075	——
	23	16127	——
VCS, VCKS	3, 9, 13, 16, 26	181728	#263496
	23	——	

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A. PURPOSE OF MANUAL

This manual has been prepared to assist the users of Vickers balanced vane type hydraulic single pumps in properly installing, maintaining and repairing their units. In the sections which follow, the single pumps are described in detail, their theory of operation is discussed and instructions are given for their proper installation, maintenance and overhaul.

The general series of models covered are V10, V20, V10F, V10P, V20F, and V20P. The information given applies to the latest design configurations listed in Table 1. Earlier designs are covered only insofar as they are similar to the present equipment.

B. GENERAL INFORMATION

1. Related Publications - Service parts information and installation dimensions are not contained in this manual. The parts catalogs and installation drawings listed in Table 1 are available from any Vickers Application Engineering office, or from:

Vickers, Incorporated
1401 Crooks Road
Troy, MI 48084

2. Model Codes - There are many variations within each basic model series, which are covered by variables in the model code. Table 2 is a complete breakdown of the code covering these units. Service inquiries should always include the complete unit model number, which is stamped on the pump cover.

TABLE 1.
PARTS CATALOGS AND INSTALLATION DRAWINGS

MODEL SERIES	PARTS DRAWING	INSTALLATION DRAWING
V10 V10F V10P	M-2005-S	MB-53
V20 V20F V20P	M-2004-S	MB-53
HYDRAULIC OIL RECOMMENDATIONS	INDUSTRIAL APPLICATIONS	MOBILE APPLICATIONS
	I-286-S	M-2950-S

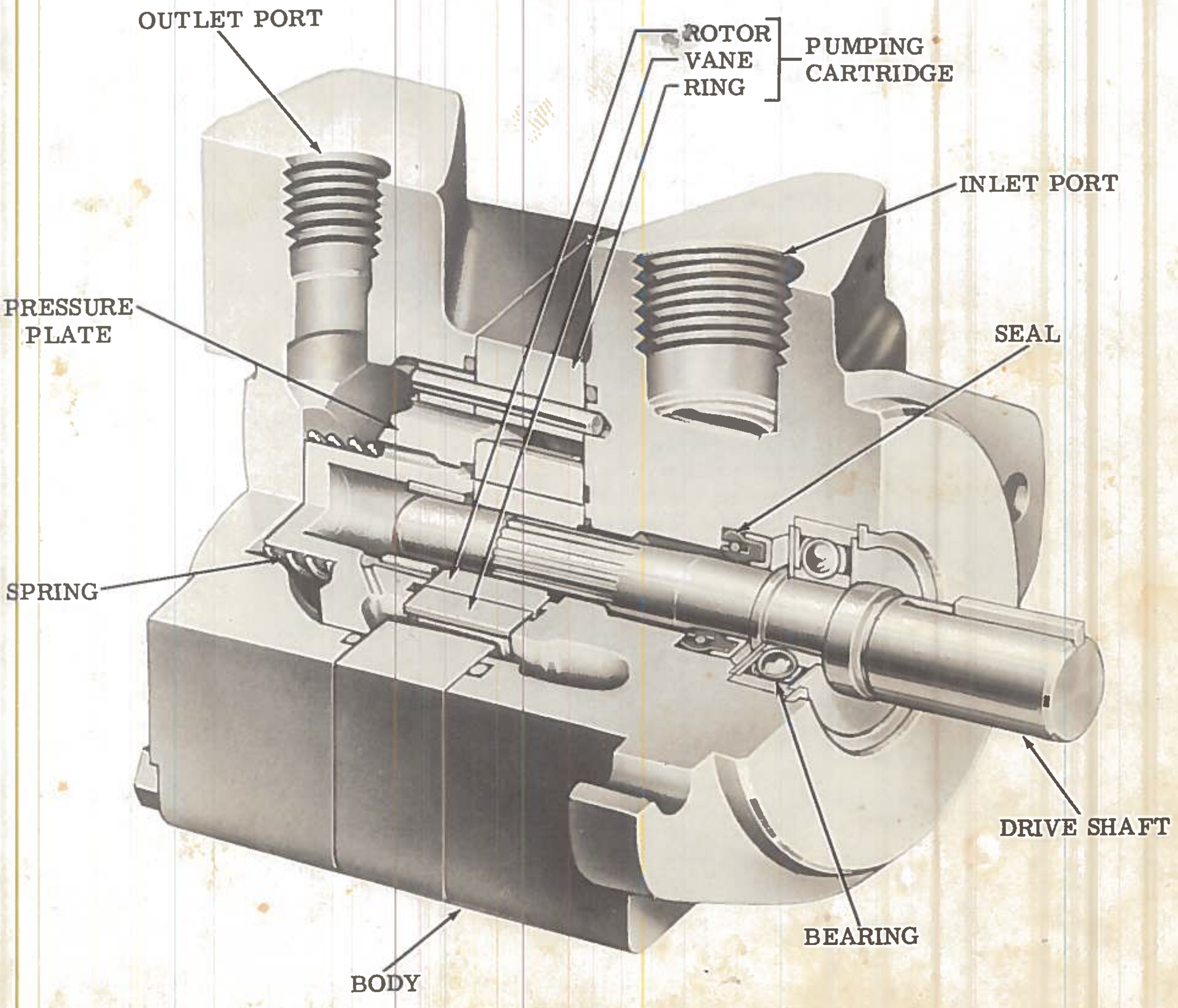

Figure 1